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ENVIRONMENTAL JUSTICE PILOT PROJECT
PROTOCOL FOR PESTICIDE AIR MONITORING IN PARLIER

2005

PREPARED BY
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
DEPARTMENT OF PESTICIDE REGULATION

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1. INTRODUCTION

1.1 Background

As part of the California Environmental Protection Agency's (Cal/EPA's) Environmental Justice Action Plan, the Department of Pesticide Regulation (DPR) will lead a pilot project in the Central Valley focusing on pesticides in a rural, farming community. This protocol describes the monitoring to be conducted for ambient air concentrations of pesticides in the Fresno County community of Parlier.

California rural communities may have higher concentrations of pesticides in ambient air compared to urban communities, due to their proximity to agricultural fields. DPR evaluated 83 communities in Fresno, Kern, Kings, Madera, Merced, Stanislaus, and Tulare counties. The communities were prioritized for consideration based on population data, availability of cumulative impact data, and pesticide use – both local and regional use. DPR also considered other factors, including air sampling feasibility, weather patterns, and the potential for collaboration with other projects focused on environmental health. Based on an analysis of all these factors, DPR selected Parlier in Fresno County (DPR, 2005).

This project will focus on monitoring ambient air concentrations of 24 pesticides. The data gathered will help DPR evaluate ambient air exposure to pesticides in order to better understand and identify opportunities to reduce environmental health risk, particularly to children. This project will include additional elements to address definitions of and guidance for cumulative impacts, precautionary approaches, and public participation.

1.2 Site Description

The city of Parlier is a small city (approximately 1.6 square miles in area) located in the San Joaquin Valley, approximately 20 miles southeast of Fresno (Figure 1). Parlier has an elevation of approximately 340 feet, with approximately 13 inches of precipitation annually. Temperatures during the summer typically range from 60 – 96 °F, and 35 – 50 °F during the winter. Winds are most frequently from the northwest at 5 – 8 miles per hour (Figure 2).

According to the 2000 U.S. Census the total population for Parlier is 11,088. Approximately 38 percent of the population is less than 18 years old, 97 percent are Hispanic, and the median family income is $24,275 per year.

Parlier is a rural community surrounded by agriculture. The major crops grown in the area are grapes and tree fruit. In 2003, approximately 249 chemicals were used for agricultural production within 5 miles of the Parlier region, with approximately 120,000 pounds used per year. Insecticides and fungicides are the most heavily used pesticides in the Parlier area. See Section 3.1 for a detailed description of pesticide use in the Parlier area.

1.3 Project Goals and Objectives

1.3.1 Overall Goals

The overall goal for this pilot project is to evaluate ambient air exposure to pesticides in order to better understand and identify opportunities to reduce environmental health risk, particularly to children. This pilot project is one of several included in Cal/EPA's Environmental Justice Action Plan. All of the pilot projects include some common elements: assessment of cumulative impacts, application of precautionary approaches, and public participation.

For the purposes of this and the other pilot projects, the Interagency Work Group (Cal/EPA secretary and heads of its boards, departments, and offices) adopted the following working definitions:

> "Cumulative impacts means exposures, public health or environmental effects from the combined emissions and discharges, in a geographic area, including environmental pollution from all sources, whether single or multi-media, routinely, accidentally, or otherwise released. Impacts will take into account sensitive populations and socio-economic factors, where applicable and to the extent data are available."
>
> "Precautionary approach means taking anticipatory action to protect public health or the environment if a reasonable threat of serious harm exists based upon the best available science or other relevant information, even if absolute and undisputed scientific evidence is not available to assess the exact nature and extent of risk."

A local advisory group (LAG) is key to ensuring meaningful public participation in this environmental justice project. The LAG includes representatives of the California Rural Legal Assistance Foundation; Californians for Pesticide Reform; Fresno County Agricultural Commissioner's office; Fresno Metro Ministry; Latino Issues Forum; LUPE (La Unión del Pueblo Entero); Parlier City government; Parlier HEAL Asthma Project; and the Parlier Unified School District. The LAG also includes a local Realtor; a local health care provider; a Parlier vintner; three farmers, including an organic farmer; and four members of the Parlier Coordinating Responsibility Authority (CoRA), a group advising the community on revitalization efforts. In addition, a Technical Advisory Group (TAG) was formed to provide guidance on the scientific elements of the pilot project. The TAG is composed of staff from federal, state, and county agencies, as well as technical specialists from the local communities.

1.3.2 Specific Project Objectives

DPR based the selection of the pesticides and community on the following objectives:

- Are residents of the community exposed to pesticides in the air?
- Which pesticides are people exposed to and in what amounts?

- Do measured pesticide air levels exceed levels of concern to human health, particularly children?

After discussion with the LAG, DPR added the following additional objectives:

- Inform the community of project, including public forums
- Reduce pesticide risk
- Conduct follow-up actions, such as education and/or regulatory actions
- Evaluate the pesticide risk relative to other pollutants monitored

1.3.4 Other Potential Monitoring

DPR may conduct monitoring for other media. For example, Parlier relies on ground water for its drinking water supply. The City of Parlier conducts routine monitoring for pesticides and other potential water contaminants. DPR will review the historical monitoring data and may supplement Parlier's monitoring with sampling for additional pesticides.

DPR will check with other regulatory agencies to determine if Parlier has any unusual sources of pesticides or other environmental contaminants.

1.4. Previous Investigations

This pilot project will provide more systematic air monitoring for a community in the Central Valley and therefore will serve as a more robust foundation for exposure assessment. DPR conducted a similar project in Lompoc (Santa Barbara County) and the U.S. Environmental Protection Agency is completing one in McFarland (Kern County). DPR will use similar methods for this study.

1.4.1 Lompoc Air Monitoring

In 2000, DPR monitored ambient air concentrations of 22 pesticides and five breakdown products simultaneously during the peak use period for most of the pesticides in Lompoc (DPR, 2003). In addition, air concentrations of three fumigants were monitored following specific applications close to the city of Lompoc (DPR, 2003). Of the 31 pesticides or breakdown products monitored in the two-part study, DPR detected 27 of them in one or more of the 451 samples collected and analyzed. Four of the 31 chemicals were below any detectable concentrations, 11 detected at quantifiable concentrations (the smallest amount that can be measured), 16 were detected at trace amounts (detectable but not measurable). While many pesticides were detected, and some quite frequently, air concentrations were low compared to health screening levels.

1.4.2 McFarland

The U.S.EPA monitored ambient air concentrations at two schools in McFarland from July 2001 to May 2002 during different agricultural seasons. The extensive study monitored 145 chemicals and took more than 900 samples (U.S.EPA, 2004). The chemicals monitored included; pesticides used in the McFarland area, volatile organic compound (VOCs), dioxins, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticide breakdown products, and dust. Of the 145 chemicals monitored, 79 were detected of which 11 were detected above a screening level, but within EPA's protective health range. The chemicals detected above their screening levels were four metals; cadmium, chromium, manganese, and arsenic, and six VOCs; carbon tetrachloride, formaldehyde, methylene chloride, benzene para-dichlorobenzene, and methyl chloride. Methyl bromide was the only pesticide found above its screening level, but within EPA's protective health range.

1.4.3 Pesticide Toxic Air Contaminant Monitoring

The Air Resources Board, in consultation with DPR, conducts ambient monitoring for a variety of pesticides in accordance with the Toxics Air Contaminant (TAC) monitoring program. Monitoring for pesticides is conducted in counties with the highest use for a particular pesticide to be monitored and during the season of highest use. Information is available from ambient air sampling conducted under the TAC program for 12 of the pesticides included in the monitoring study in Parlier: 1,3-dichloropropene, chlorpyrifos, diazinon, endosulfan, EPTC, malathion, MITC, methyl bromide, molinate, permethrin, propargite, simazine, and S,S,S-tributyl phosphorotrithioate. Summaries of the TAC monitoring are given in Attachment I.

2. PROJECT PERSONNEL

DPR's standard project organization and responsibilities are described in SOP ADMN002.00 (Attachment II). This project is under the overall management of John Sanders, Branch Chief, DPR-Environmental Monitoring Branch. Other key personnel assigned to this project include:

Project Leader:	Randy Segawa Senior Environmental Research Scientist, DPR (916) 324-4137 rsegawa@cdpr.ca.gov
Field Sampling Coordinators:	Clarice Ando and Pam Wofford Associate Environmental Research Scientists, DPR
Senior Scientist:	Bruce Johnson Senior Environmental Research Scientist, DPR
Laboratory Liaison and Quality Assurance:	Carissa Ganapathy Associate Environmental Research Scientist, DPR
Pesticide Risk Evaluation:	Jay Schreider Primary State Toxicologist, DPR

Pest Management Analysis:	Pat Matteson Associate Environmental Research Scientist, DPR
Environmental Justice Coordinator:	Veda Federighi Assistant Director, DPR
Chemical Analysis:	Department of Food and Agriculture, Center for Analytical Chemistry Air Resources Board, Monitoring and Laboratory Division

In addition, to the personnel described above, other people have key roles for this specific project. DPR formed the LAG to assist with the project. The LAG advises DPR on overall project goals and priorities. The TAG will assist DPR in the planning of pesticide air monitoring and evaluation of results. DPR will also establish a multi-agency quality assurance team to perform audits of the monitoring.

3. SAMPLE COLLECTION DESIGN AND METHODS

The design for sample collection is a product of community and technical input from the TAG and LAG. This section describes the pesticides and other chemicals that will be monitored, types of samples to be collected, sample measurement details, monitoring locations and frequency, and other information pertinent to field collection and shipment of samples.

3.1 Pesticides and Other Chemicals Included in the Project

DPR will conduct air monitoring for 24 pesticides and five pesticide breakdown products that were among the top 100 used within five miles of Parlier during 2003. Table 1 lists these pesticides and breakdown products and gives some key chemical and physical characteristics. The monitoring will include an additional 13 pesticides not among the top 100 used within five miles of Parlier because they are easily included at no extra cost with the methods and many have high use in other areas. DPR selected the pesticides for monitoring based on: (1) toxicity, (2) vapor pressure (volatility), (3) use, (4) availability of sampling and laboratory methods, and (5) ability to include a pesticide in a multi-residue method. DPR selected the pesticides for monitoring in two phases. Pesticides selected in the first phase were used as part of the criteria for selecting a community for monitoring. The pesticides selected in the first phase were based in part on statewide use. Once DPR selected Parlier for monitoring, the second phase refined the pesticides selected for monitoring based on pesticide use in the Parlier area.

Following discussions with the LAG and TAG, DPR selected 25 pesticides and four pesticide breakdown products (Table 2) for monitoring in a single multi-residue method. DPR also selected metam-sodium for monitoring as a single chemical. Metam-sodium rapidly breaks down to methyl isothiocyanate (MITC), the primary pesticidal agent. DPR will monitor for MITC rather than metam-sodium. In addition, the Air Resources Board (ARB) will assist

DPR in monitoring for toxic air pollutants, that includes 33 volatile organic compounds (VOCs) and 33 metals/elements (Table 3). As indicated in Table 3, ARB's VOC and metals/elements methods include several pesticides. The ARB and San Joaquin Valley Air Pollution Control District (SJVAPCD) also conduct monitoring near Parlier for 57 hydrocarbons and 12 aldehydes (Table 4) as part of the Photochemical Assessment Monitoring Stations program. A number of the VOCs and hydrocarbons included in the monitoring are likely inert ingredients in some of the pesticide products used in the Parlier area. ARB and SJVAPCD will also monitor for several criteria air pollutants in or near Parlier, including ozone and particulate matter (Table 5).

A number of important pesticides are not included in the monitoring due to resource limitations. DPR evaluated the top 100 pesticides used statewide as candidates for monitoring by rating these pesticides on toxicity, volatility and statewide use. Those pesticides with higher toxicity, higher volatility, and higher use were rated higher for monitoring. Table 6 shows the highly rated pesticides and which ones are included in the monitoring. While most of the pesticides with high use statewide also have high use in the Parlier area, a few pesticides have high use in Parlier, but not statewide. Table 7 shows the high-use pesticides in the Parlier area and which ones are included in the monitoring. Most of the high-use pesticides in the Parlier area not included in the monitoring are not highly rated for monitoring due to low toxicity and low volatility, with captan, chloropicrin, paraquat, and ziram being the exceptions.

Tables 8 and 9 show the amounts of pesticides reported and crops treated for the monitored pesticides. Figures 3 – 6 show the locations of high pesticide use in the Parlier area. Similar to other areas in the state, copper, sulfur, and the fumigants are the highest use pesticides, by far. In the Parlier area, grapes and fruit trees are the predominant crops treated with pesticides. Attachment III summarizes the products, crops, and target pests for the monitored pesticides.

3.2 Sampling Locations and Frequency

DPR considered several monitoring locations in Parlier, assessing each site based on the following criteria:

- Close proximity to high use areas for multiple pesticides monitored
- Close proximity to populated areas
- Sampling point meets all U.S. EPA ambient air siting criteria
    - 2 – 15 meters above ground
    - At least 1 meter horizontal and vertical distance from supporting structure
    - Should be at least 20 meters from trees
    - Distance from obstacles should be at least twice the obstacle height
    - Unobstructed air flow for 270°
- Accessible to sampling personnel during time of sampling
- Accessible to electrical outlets
- Secure from equipment loss or tampering
- Permission of property owner

Air monitoring will occur at four locations in or near Parlier: Martinez Elementary School, Chavez Elementary School, Kearney Agricultural, and Benavidez Elementary School (or Parlier Junior High School) (Figure 7). DPR will conduct pesticide monitoring at Martinez School, Chavez School, and Benavidez School (or Parlier Junior High School). ARB will conduct VOC, metal/element, and criteria air pollutant monitoring at Benavidez School (or Parlier Junior High). SJVAPCD will conduct hydrocarbon, aldehyde, and criteria air pollutant monitoring at the Kearney Agricultural Center.

DPR selected Martinez, Chavez, and either Benavidez or Parlier Junior High schools because they are in the northwest corner, southeast corner, and center of Parlier, respectively. DPR gave priority to placing monitoring locations at the edge of town and near agricultural areas, where the highest pesticide air concentrations are expected. While pesticides are applied in all areas surrounding Parlier, greater amounts of certain pesticides are applied west of Parlier, and other pesticides are applied in greater amounts east of Parlier (Figures 3 – 6). In addition, the predominant wind direction is from the northwest, so that Martinez Elementary School may have higher concentrations compared to the rest of Parlier, all other factors being equal. Benavidez Elementary School (or Parlier Junior High School) was selected because it is located near the center of Parlier and is likely the most representative single location in Parlier. VOCs, metals/elements, and particulate matter can only be monitored at a single location. Benavidez School will provide comprehensive data for both pesticides and other air pollutants at a single location. Kearney Agricultural Center was selected because SJVAPCD currently conducts its monitoring there on a routine basis.

All pesticide samples will be 24 hours in duration, and DPR will collect samples three days per week for 52 consecutive weeks (one year), at all three school locations. DPR will not establish a set schedule for sampling, but instead vary the three days sampled each week based on logistical and other considerations. ARB will collect VOC (including 1,3-dichloropropene and methyl bromide) and metal/element (including copper and sulfur) samples one day per week for 52 consecutive weeks and Benavidez School. Table 10 gives the locations, frequency of monitoring, and number of samples for the pesticides and other air pollutants included in the project.

LAG – The proposal to sample 3 days/wk at 3 sites maximizes the number of samples we collect. However, we must spread the costs over two fiscal years in order to do this. One of the drawbacks is that we will need to delay the start of sampling until January 2006. It is possible to start earlier if we collect fewer samples, such as 3 or 4 days/wk at 2 sites. DPR would like your comments on this issue.

3.3 Sample Type

The most widely used procedure for atmospheric measurement of pesticides is to pass 2 to 100 liters of air per minute through a solid sorbent material onto which the pesticide is adsorbed (Keith, 1988). Sorbent media typically used to trap pesticides include XAD resins and carbon sorbents such as charcoal (Majewski and Capel, 1995; Keith, 1988; Baker *et al.*, 1996). Sorbent tube samples will be collected according to procedures listed in DPR'S SOP EQAI001.00 (Attachment II). The multiresidue air monitoring will be conducted using

Andersen air sampling pumps equipped with a sampling tube containing 30 mL of XAD-4 set at a flow rate of 15 L/min. MITC samples will be collected with SKC Inc. personal sample pumps equipped with 200/400 mg coconut charcoal tubes (SKC Inc., #226-09) set at an air flow rate of 1.5 liters per minute (L/min). The use, operation, calibration and maintenance of SKC air sampling pumps are described in DPR's SOP EQAI001.00 (Attachment II).

Once samples are collected, each tube opening will be tightly capped and samples will be placed on dry ice and remain frozen until analysis. Sample handling and shipping will follow procedures defined in DPR's SOP QAQC004.01 (Attachment II). Samples will follow the tracking procedures outlined in DPR's SOP QAQC003.01 (Attachment II). Samples will be transported to the analytical laboratory once a week.

With ARB's assistance, DPR will monitor for VOCs, including the fumigants 1,3-dichloropropene and methyl bromide. These samples will be 24 hours in duration and collected in stainless steel Summa canisters. ARB NEEDS TO REVIEW

With ARB's assistance, DPR will monitor for metals/elements, including the pesticides copper and sulfur. These samples will be 24 hours in duration and collected on glass micro-fiber filters. ARB NEEDS TO REVIEW

Prior to monitoring, sample labels with the study number and sample identification numbers will be attached to the tubes. Preparation of sorbent tubes for use with air sampling pumps is described in DPR's SOP FSAI001.01 (Attachment II). Chain of custody forms, and sample analysis request forms will be supplied to field sampling personnel. Field personnel will collect field notes on sampler location and weather observations during the monitoring study.

3.4 Field Tests

The flow rate for each sampler will be measured and recorded before and after each sampling interval. Flows will be measured with DryCal® Primary Flowmeters and recorded on the chain of custody.

May need to revise to describe flow measurement for Anderson air samplers.

3.5 Quality Control for Field Sampling

In addition to field samples collected during monitoring, fortified field spikes and (co-located) duplicate samples will be collected.

A fortified field spike is a laboratory spike, which is sent to the field and placed on an air sampler with air flowing through the sorbent cartridge. Shipped on dry ice to the field, it is treated just like a field sample, including storage and shipping conditions. The fortified spike, in comparison with the respective field sample, gives us some information about any change in the ability to recover the analyte during air sampling. DPR will collect one fortified field spike every other week.

A duplicate sample is a sample that is co-located with a field sample. These samples serve to evaluate overall precision in sample measurement and analysis. DPR will collect one duplicate sample every other week.

The site and time of duplicate sampling and fortified sampling is randomly assigned.

3.6 Meteorological Monitoring

Locations of the meteorological stations are shown in Figure 3.

A California irrigation management information center (CIMIS) is located at the UC Kearney research facility. The CIMIS station provides hourly data for precipitation, solar radiation, vapor pressure, air temperature, relative humidity, dew point, wind speed, wind direction, and soil temperature.

The SJVAPCD will collect weather data at their station located near Parlier. The station collects hourly data on wind speed, wind direction, air temperature, and relative humidity.

In addition, a sampling trailer supplied by ARB to collect air samples for analysis by the ARB laboratory will also be equipped with meteorological equipment to measure wind speed and direction, and temperature. The trailer will be located at Benavidez School (or Parlier Junior High). ARB NEEDS TO REVIEW

3.7 Pesticide Use Data

Pesticide use data will be collected from pesticide use reports submitted by growers to the County Agriculture Commissioner's Office. Universal use reporting, required by the state of California, directs all growers to submit details of pesticide usage on a monthly basis. All pesticide use data will be collected for the agricultural area within five miles from Parlier. The township, range and sections that will be used to define the agricultural boundary of the study area are listed in Table 11 and mapped in Figure 4. Pesticide use reports contain the following information:

- Operator identification
- Date of application
- County of application
- Pesticide product applied
- Amount of pesticide product applied
- Area/amount treated
- Site/commodity treated
- Field identification
- Location – meridian/township/range/section

4. SAMPLE ANALYSIS DESIGN

4.1 Laboratory Analysis Methods

Chemical analysis will be performed by the California Department of Food and Agriculture Center for Analytical Chemistry (CDFA). For the XAD cartridges, the laboratory will follow method SOP ?? (Attachment II). Pesticides will be extracted from the sorbent using ?? and analyzed with a liquid chromatograph – mass spectrometer. SOPs NOT COMPLETED

CDFA will analyze MITC samples following SOP EM 41.9 (Attachment II). In this method, the MITC is extracted from the charcoal tubes using one percent carbon disulfide in ethyl acetate and analyzed using a gas chromatograph with a nitrogen/phosphorous detector.

ARB will analyze the Summa canister samples for VOCs according to SOPs 052-1.0, 057-1.0, and 058-2.0 (Attachment II). ARB will analyze the filter samples for metals/elements according to SOP 005-6.0 (Attachment II). ARB NEEDS TO REVIEW

4.2 Criteria Air Pollutant Monitoring

The ARB and SJVAPCD will monitor for the criteria air pollutants ozone, carbon monoxide, nitrogen dioxide, and particulate matter-2.5 microns. Ozone will be monitored continuously and recorded as hourly averages using ultraviolet photometry. Carbon monoxide will be monitored continuously and recorded as hour averages using non-dispersive infrared photometry. Nitrogen dioxide will be monitored continuously and recorded as hourly averages using gas phase chemiluminescence. Particulate matter, less than 2.5 microns in diameter will be monitored continuously and recorded as hourly averages using a beta attenuation monitor. ARB NEEDS TO REVIEW

4.3 Quality Assurance

The CDFA laboratory will follow DPR's standard laboratory quality control procedures, described in SOP QAQC 001.00 (Attachment II). Prior to the analysis of field samples, the laboratory will validate the method by analyzing a series of spikes (samples containing known amounts of pesticides) to document the precision and accuracy of the methods. Trapping efficiency tests will be performed to ensure breakthrough (pesticides not adsorbed to the sorbent tube) does not occur and to check for chemical transformation of the adsorbed pesticides. Storage stability tests will be performed to document the degradation of samples between the time of sample collection and the time of sample analysis. The laboratory will include quality control samples with each batch of field samples analyzed, including blank samples (samples containing no pesticides) to check for contamination, and spikes to check the precision and accuracy.

DPR will establish a quality assurance team to perform audits of the project procedures. ARB will lead the quality assurance team and it will submit a questionnaire to the laboratories participating in this study. Subsequent to mailing this questionnaire, the quality assurance team will visit the laboratories before or near the beginning of the study. The audit will result in a list of items that will assist the laboratories in their efforts to produce quality data. The quality assurance team will schedule another audit during sample analysis for each laboratory. A review of raw data and laboratory tracking procedures will be conducted on a minimum of five percent of all samples collected. QA TEAM NEEDS TO REVIEW

4.4 Method Detection Limit and Limit of Quantitation

The laboratory determined the method detection limit for each analyte by analyzing a standard at a concentration with a signal to noise ratio of 2.5 to 5. The spiked matrix is analyzed at least seven times, and the method detection limit is determined by calculating the 99% confidence interval of the mean. This procedure is described in detail in U.S. EPA (1990). The limit of quantitation is set a certain factor above the method detection limit. The level of interference found in the samples determines this factor: the more interference, the higher the factor. The method detection limits and limits of quantitation for each pesticide are given in Table 12.

5. DATA ANALYSIS

5.1 Calculation of Air Concentrations

Twenty-four-hour air concentrations will be calculated from the weight of analyte per sample (determined in the chemical analysis) divided by the volume of air drawn through an air sampler during the corresponding sampling period. Concentrations will be reported in nanograms per cubic meter (ng/m^3) and also converted to parts per billion, volume per volume. Samples below the limit of detection will be treated as having one-half the detection limit.

DPR will estimate the pesticide air exposure for acute, seasonal, and chronic scenarios. Acute exposure will be estimated for each monitoring from the individual 24-hour samples by calculating the 95^{th} percentile concentration for each pesticide. Seasonal exposure will be estimated for each monitoring location from the individual 24-hour samples by calculating the average concentration during the peak season of use for each pesticide. Chronic exposure will be estimated for each monitoring location from the individual 24-hour samples by calculating the average concentration of all samples (one year) for each pesticide.

5.2 Health Evaluation Methods

DPR will compare these measured ambient air concentrations to human health screening levels to determine what, if any, action to take (Table 13). No state or federal agency has established regulatory health standards for pesticides in air. Therefore, DPR in consultation with the TAG, will develop health screening levels for monitored pesticides to place the results in a health-based context. Although not regulatory standards, these screening levels can be used in the process of evaluating the air monitoring results. A measured air level that is below the screening level for a given pesticide would generally not be considered to represent a significant health concern and would not generally undergo further evaluation, but also should not automatically be considered “safe” and could undergo further evaluation. By the same token, a measured level that is above the screening level would not necessarily indicate a significant health concern, but would indicate the need for a further and more refined evaluation. Significant exceedances of the screening levels could be of health concern and would indicate the need to explore the imposition of mitigation measures.

To the extent possible, the screening levels will be based on toxicology values taken from existing documents. The two primary sources are risk assessments, in the form of Risk Characterization Documents (RCDs) completed by DPR, and risk assessments included in Reregistration Eligibility Documents (REDs) completed by U.S. EPA. These documents specified the studies and toxicity values to be used for various exposure scenarios (e.g. acute inhalation, chronic exposure, etc.). When REDs or RCDs are not available or appropriate values are not available, the primary source will be the DPR Toxicology Database.

The potential health risk of a chemical(s) in air is a function of both the inherent toxicity of the chemical(s) as well as the level of exposure to the chemical(s). The potential health risk to community residents from exposure to pesticides in the air can be evaluated by comparing the air concentration measured over a specified time (e.g. 24 hours, one month, one year) with the screening level derived for a similar time (acute, seasonal, chronic). The ratio of an exposure level for a chemical (measured air concentration of a pesticide) to a reference concentration or screening level for that pesticide is called the Hazard Quotient (HQ). In this case,

$$\frac{\text{Air concentration}}{\text{Screening level}} = \text{Hazard quotient}$$

A hazard quotient is the air concentration detected expressed as the percentage of the screening level. For example, if the air concentration were 25 percent of the screening level, then the hazard quotient would be 0.25. When the hazard quotient is greater than one, the air concentration would exceed the screening level and further analysis of the data would be required.

Overexposure to pesticides can cause a variety of adverse health effects. An overview of the potential health effects for pesticides included in the monitoring is given in Attachment IV. Pesticides may exhibit toxic effects independently, or they may interact in an additive, synergistic, or antagonistic manner. As a preliminary approach, DPR will estimate risk from multiple pesticides by adding all of the hazard quotients for the individual pesticides:

$$\begin{aligned} \text{Hazard Index} = \quad & \text{Hazard Quotient of Pesticide 1} \\ & + \text{Hazard Quotient of Pesticide 2} \\ & + \text{Hazard Quotient of Pesticide 3} \ldots \text{(and so forth)} \end{aligned}$$

This approach assumes that toxicity and risk of all monitored pesticides are additive, although only a subset of the monitored pesticides (including organophosphate insecticides and oxygen analog breakdown products toxic to the nervous system) are known to act in an additive manner. U.S. EPA has developed more refined methods for analyzing cumulative impacts of pesticides, and these, the hazard quotient approach, and other avenues will be explored.

Should levels of pesticides be found above screening levels, it can trigger additional data collection and evaluation, in Parlier and elsewhere. The data helps DPR to evaluate the geographic scope, timing and use factors that contributed to the air concentrations. These and other data can establish parameters of problematic residues. The data are necessary to develop effective measures to minimize or eliminate unacceptable air exposures, and are required by law to support regulatory action.

5.3 Methods for Estimating Air Concentrations for Locations, Time Periods, and Pesticides Not Monitored

In some studies, computer modeling can be attempted to estimate ambient air concentrations from pesticide applications made during monitoring, provided meteorological measurements and application/sampling site information are available. Thus, modeling can be used to supplement measured air concentrations to determine potential concentrations at places and time periods other than the ones monitored, or in the event a large application, or one close to the city limits occurs. The strength of this approach is the flexibility afforded by modeling. It can provide air concentration estimates within city limits given application scenarios that occur outside of the monitoring period.

Using the data collected from the County Agricultural Commissioner's Office on pesticide use within the study area, an attempt will be made to use modeling to estimate air concentrations expected at locations other than sampling sites within the city area of Parlier. Modeling may be able to estimate concentration of the applied pesticides during times when samples were not collected. The U.S. EPA gaussian plume dispersion model, Industrial Source Complex Short Term model (U.S. EPA, 1995) will be used to estimate the modeled concentrations. As model inputs, DPR will use the following: 1) flux rates back-calculated from application site monitoring using the procedures described in Ross, et al. 1996, or measured flux rates from other studies; 2) weather data recorded during the monitoring period. Additional parameters and modifications to this proposed modeling scheme could be addressed in future TAG meetings.

5.4 Estimating Cumulative Impacts

The Office of Environmental Health Hazard Assessment will lead the evaluation of cumulative impacts for all Cal/EPA pilot projects, including DPR's. This evaluation will include a comparison of the relative risk for all monitored chemicals (pesticides and non-pesticides). In addition, an evaluation of multi-media exposure using other available monitoring data (e.g., contaminants in drinking water) will be included. OEHHA NEEDS TO REVIEW

6. RELATED PROJECTS

DPR hopes to collaborate with several others to provide additional information on potential health effects of pesticides and other pollutants in Parlier.

6.1 University of California, Davis (UCD)

Kent Pinkerton of UCD’s Center for Health and the Environment is interested in collaborating on this project to examine the potential health effects of exposure to ambient airborne particles to the respiratory system in the Parlier area. In collaboration with engineers at UCD and the University of Southern California, the Center for Health and the Environment has acquired a special mobile system that allows them to concentrate in real-time, airborne particles to levels 20 to 40-fold above ambient concentrations. The system is designed to uniformly capture and concentrate particles from ultrafine (20 nanometer) to coarse (10 micron) size. These particles are concentrated without ever letting the particles deposit on a surface. In this manner small laboratory animals can be exposed to these concentrated particles in real time while the particles are passing through this system. In essence, with this system animals can be exposed to real world particles under conditions that might mimic a bad air pollution day. DPR will work with UCD to find a suitable location for this system in or near Parlier. UCD NEEDS TO REVIEW

6.2 University of California, San Francisco (UCSF)

Tim Tyner of UCSF’s Valley Air Pollution and Health Effects Research (VAPHER) Institute in Fresno proposes a study on the health impacts of cumulative pesticide exposures on children in Parlier. This case-crossover study will assess the acute effects of pesticide/pollutant exposures on the probability of a health event. VAPHER will collect children’s health data in Parlier from the United Health Center clinic, four elementary schools, and asthma data from the Health Education and Access for Life program. VAPHER will attempt to evaluate the recorded health events with pesticide air concentrations to determine if there are any correlations. UCSF NEEDS TO REVIEW

CA ENVIRONMENTAL HEALTH TRACKING MAY ADD A SECTION

7. RISK REDUCTION AND PRECAUTIONARY APPROACHES

7.1 Pest Management Analysis

DPR’s Pest Management Analysis and Planning Program will conduct a study in the project area of cropping patterns, pest pressures, pest control practices, pesticide use, application methods, and alternative pest management techniques, with a focus on integrated pest management. DPR will coordinate its study with ongoing work already being done in the Parlier area: for example, the Almond Pest Management Alliance and Outreach Project; DPR’s federally funded project to develop organophosphate alternatives for stone fruit; the Code of Sustainable Winegrowing Practices developed by the California Association of Winegrape Growers and the Wine Institute; and research and extension activities by the world-renowned University of California Kearney Agricultural Center in Parlier, in particular those directed towards the development of ecologically-based pest management systems for insect pests in orchards and vineyards.

7.2 Evaluation of Results and Follow-up Actions

The monitoring results will be evaluated to determine the exposure and risk from individual as well as multiple pesticides. The data will be compared to historical monitoring results from other areas. DPR will also evaluate the results and pesticide use patterns at the time of monitoring to determine possible mitigation measures, as well as other potential areas and time periods for future monitoring. DPR is developing sampling and laboratory methods that provide flexibility so that they can be used in other areas with minimal additional work.

With assistance from ARB, DPR will also compare air concentrations of criteria pollutants, volatile organic compounds, and metals in Parlier with other areas of the state and determine if Parlier has elevated levels of these pollutants.

In situations where ambient air levels of pesticides lead to exposures of regulatory concern, DPR determines options to reduce ambient air concentrations. The options range from regulatory restrictions on the use of certain pesticides to seeking grant monies to promote alternative pest management strategies. While the focus of these efforts may be derived from the results of air monitoring, if other datasets evaluated by DPR (for example, groundwater pesticides data) demonstrate the need for further action, DPR addresses these also.

This project presents a number of opportunities for exploring the precautionary approach and supporting growers in the process. The type of actions DPR may take to change pesticide use practices can include:

- Collaborative efforts can be pursued with UC Cooperative Extension and the United States Department of Agriculture Natural Resources Conservation Service on education and financial support for growers on pest management alternatives. Evaluating and promoting the use of alternatives is a key element of precaution.

- DPR may seek grant monies to support public/private partnerships to develop and promote pest management alternatives.

- DPR's study of pest management practices in the Parlier area is intended in part to identify lower-risk alternatives. Outreach efforts will be explored to ensure that farmers are aware of the availability of and familiar with the use of these alternatives.

- A risk reduction approach could be focused on local and state enforcement efforts on eliminating illegal pesticide application practices that result in problematic levels of pesticides in air.

- Training pesticide applicators on best management practices (BMPs) can also be expanded. (BMPs are management and cultural activities and practices, general good housekeeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices or devices, or prohibitions of practices, to prevent or minimize harm to health and the environment. These practices are defined by research and field testing to be the most effective and practicable methods.)

- DPR can also work with the registrant and the U.S. Environmental Protection Agency to make improvements to the pesticide product label. Among other elements, the label includes instructions and restrictions on product use. (Under federal law, states are precluded from mandating changes in pesticide labels.)

These and other risk reduction measures can be used singly or in combination.

8. SCHEDULE

The following is the estimated schedule for completing this project. All dates are subject to change.

Activity	Start Date	End Date
Write protocol	August 1, 2005	October 14, 2005
Collect field samples	January 9, 2006	January 8, 2007
Conduct laboratory analysis	January 16, 2006	February 2007
Conduct data analysis	March 2006	August 2007
Issue first progress report	April 2006	
Issue second progress report	October 2006	
Issue third progress report	April 2007	
Write final report	July 2007	October 2007
Conduct public forum	October 2007	

A JANUARY START FOR SAMPLING ALLOWS DPR TO COLLECT THE MAXIMUM NUMBER OF SAMPLES. SAMPLING CAN BE STARTED EARLIER IF FEWER SAMPLES ARE COLLECTED.

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TABLES

Table 1. Characteristics of pesticides and breakdown products included in the monitoring and among the top 100 used within five miles of Parlier during 2003.

Pesticide	Breakdown Product	Use	Molecular Weight (g/mole)	Water Solubility 9 – 25 C (ppm)	Vapor Pressure 20 – 25 C (mmHg)	Hydrolysis Half-Life 19 – 25 C pH 6 – 7.5 (days)	Soil Aerobic Half-Life (days)	Soil Photolysis Half-Life (days)
1,3-dichloropropene		Fumigant	111.0	2,250	29.4	NA	11.5	NA
Azinphos-methyl		Insecticide	317.3	28.0	1.60E-06			
Chlorpyrifos	Oxygen analog	Insecticide	350.6	1.39	2.21E-05	72.1	NA	10
Copper (sulfate)		Fungicide	249.7	230,500	nonvolatile	NA	NA	NA
Cypermethrin		Insecticide	416.3	4.00E-03	1.30E-09	>50	6-20	
Diazinon	Oxygen analog	Insecticide	304.3	60	8.98E-05	138	40	2.55
Dicofol		Insecticide	370.5	NA	3.90E-06	2.74	66.4	60.2
Dimethoate	Oxygen analog	Insecticide	229.2	39,800	1.85E-06	68	2	66.7
Diuron		Herbicide	233.1	36.4	6.90E-08	1240	372	
Iprodione		Fungicide	330.17	12.2	1.00E-07	4.73	65	13.7
Malathion	Oxygen analog	Insecticide	330.3	125	2.30E-05	6	2	174
Methyl bromide		Fumigant	94.95	1,380	1420	17	1.5 - 20	NA
Metam-sodium (not monitored)[a]	Methyl isothiocyanate	Fumigant	73.1	8,610	16.0	20.4	0.5 - 50	1.1
Metolachlor		Herbicide	283.8	492	3.14E-05	200[f]	26	37
Naled		Herbicide	380.8	2,000	2.00E-04	0.68	3	5
Norflurazon		Insecticide	303.67	33.7	2.90E-08	~2,650	134	21.2
Oryzalin		Herbicide	346.36	2.6	9.75E-09	>30	6.33	3.95
Oxyfluorfen		Herbicide	361.7	0.116	NA	114	293-576	199
Permethrin		Herbicide	391.3	0.07	2.15E-08	42	10.5	289
Propargite		Insecticide	350	0.5	3.89E-08			
Simazine		Insecticide	201.7	6	2.21E-08	28[b]	110	11.1
Sulfur		Fungicide	32.1	insoluble	3.95E-06	Not degraded	Not degraded	Not degraded
Trifluralin		Herbicide	335.3	0.3	1.04E-04	30	169	41

NA – Not available
[a] Metam-sodium breaks down in a few minutes to the pesticidal agent methyl isothiocyanate (MITC).
[b] No reaction occurred during the study. The half-life is greater than the value listed which represents the length of the study.

Table 2. Pesticides and pesticide breakdown products included in DPR's multi-residue method. Pesticides in blue/bold were among the top 100 used within five miles of Parlier during 2003. These pesticides will be monitored at Chavez School, Martinez School, and Benavidez School (or Parlier Jr. High) three days per week.

Pesticide (Active Ingredient)	Breakdown Product	Product Trade Names
Azinphos-methyl		**Guthion**
Chlorpyrifos	**Oxygen analog**	**Dursban, Lorsban**
Cypermethrin		**Ammo, Demon, Raid**
Diazinon	**Oxygen analog**	**AG-500, Diazol**
Dicofol		**Kelthane**
Dimethoate	**Oxygen analog**	**Cygon, De-Fend**
Diuron		**Direx, Karmex**
Endosulfan	Endosulfan sulfate	Thiodan
EPTC		Eptam
Iprodione		**Rovral, Chipco**
Malathion	**Oxygen analog**	
Metolachlor		**Pennant, Bicep, Dual**
Molinate		Ordram
Naled (not monitored)	**DDVP**	**Dibrom**
Oryzalin		**Surflan**
Oxyfluorfen		**Goal, Galigan**
Norflurazon		**Solicam, Predict**
Permethrin		**Pounce, Ambush**
Phosmet		**Imidan**
Propanil		Duet, Stam, Wham
Propargite		**Omite, Comite**
SSS-tributyltriphosphorotrithioate (DEF)		DEF
Simazine		**Princep, Sim-Trol**
Thiobencarb		Bolero, Abolish
Trifluralin		**Treflan, Triap, Trilin**

DPR will also monitor methyl isothiocyanate (MITC) as a single chemical.

Metam-sodium (not monitored)	**Methyl isothiocyanate**	**Vapam, Busan, Sectagon**

Table 3. Chemicals included in ARB's volatile organic compound (VOC) and metals/elements methods. Chemicals in blue/bold are pesticides that were among the top 100 used within five miles of Parlier during 2003. Chemicals in blue/italics are pesticides not among the top 100 used within five miles of Parlier during 2003. Trade names are given in parentheses. These chemicals will be monitored at Benavidez School (or Parlier Jr. High) one day per week.

VOCs	Metals/Elements
Acetaldehyde	Aluminum
Acetone	Antimony
Acetonitrile	*Arsenic (several)*
Acrolein (Magnacide)	Barium
Acrylonitrile	Beryllium
Benzene	Bromine
1,3-Butadiene	Cadmium
Carbon Disulfide (Enzone)	Calcium
Carbon Tetrachloride	Chloride
Chlorobenzene	Chromium
Chloroform	Cobalt
meta-Dichlorobenzene	**Copper (several)**
ortho-Dichlorobenzene	Hexavalent Chromium
para-Dichlorobenzene	Iron
cis-1,3-Dichloropropene (Telone, Inline)	Lead
trans-1,3-Dichloropropene (Telone, Inline)	Manganese
Ethyl Benzene	Mercury
Ethylene Dibromide	Molybdenum
Ethylene Dichloride	Nickel
Formaldehyde (Aldesan, Bactron)	Phosphorus
Methyl Bromide (Brom-O-Gas, Metabrom, Pic-Brom,)	Potassium
Methyl Chloroform	Rubidium
Methyl Ethyl Ketone	Selenium
Methyl tertiary-Butyl Ether	Silicon
Methylene Chloride	Strontium
Perchloroethylene	**Sulfur (several)**
Styrene	Tin
Toluene	Titanium
Trichloroethylene	Uranium
meta/para-Xylene (several)	Vanadium
meta-Xylene (several)	Yttrium
ortho-Xylene (several)	Zinc
para-Xylene (several)	Zirconium

Table 4. Chemicals included in the SJVAPCD's Photochemical Assessment Monitoring Stations program. These chemicals will be monitored at the Kearney Agricultural Center approximately 0.5 miles southeast of Parlier once every three days during July – September.

Hydrocarbons		**Aldehydes**
ACETYLENE	n-PENTANE	Acetaldehyde
BENZENE	MCPENTANE	Acetone
n-BUTANE	cis-2-PENTENE	Acrolein
1-BUTENE	n-PROPBENZENE	Benzaldehyde
cis-2-BUTENE	PAMHC	Butyraldehyde
CYCLOHEXANE	1-PENTENE	Crotonaldehyde
CYCLOPENTANE	trans-2-PENTENE	Formaldehyde
n-DECANE	PROPANE	Hexaldehyde
m-DIETHYLBENZENE	PROPYLENE	MEK & Methacrolein
p-DIETHYLBENZENE	STYRENE	Propionaldehyde
2,2-DIMETHYLBUTANE	TNMOC as propane (ppbc)	Tolualdehyde
2,3-DIMETHYLBENZENE	TOLUENE	Valeraldehyde
2,3-DIMETHYLPENTANE	1,2,3-TRIMETHYLBENZENE	
2,4-DIMTHYLPENTANE	1,2,4-TRIMETHYLBENZENE	
n-DODECANE	1,3,5-TRIMETHYLBENZENE	
ETHANE	2,2,4-TRIMETHYLPENTANE	
ETHYLENE	2,3,4-TRIMETHYLPENTANE	
ETHYLBENZENE	n-UNDECANE	
m-ETHYLTOLUENE	m/p-XYLENES	
o-ETHYLTOLUENE	o-XYLENE	
p-ETHYLTOLUENE		
n-HEPTANE		
n-HEXANE		
1-HEXENE		
ISOBUTANE		
ISOPENTANE		
ISOPRENE		
ISOPROPBENZENE		
METHYLCYCLOHEXANE		
2-METHYLHEXANE		
2-METHYLPENTANE		
3-METHYLHEXANE		
3-METHYLPENTANE		
2-MHP		
3-MHP		
NONANE		
n-OCTANE		

Table 5. Criteria air pollutants monitored continuously by the ARB and SJVAPCD in or near Parlier.

ARB Benavidez Elementary School (or Parlier Jr. High)	**SJVAPCD Kearney Agricultural Center**
Particulate Matter-2.5 microns	Carbon Monoxide
	Nitrogen Dioxide
	Ozone

Table 6. Highest rated pesticides for monitoring based on statewide use, volatility, and toxicity (risk assessment priority). Pesticides in blue/bold are included in the monitoring.

Pesticide	Statewide Use Rating	Volatility Rating	Risk Assess Rating	Total Rating
1,3-DICHLOROPROPENE	**4**	**4**	**4**	**12**
CHLOROPICRIN	4	4	4	12
METAM-SODIUM [MITC]	**4**	**4**	**4**	**12**
METHYL BROMIDE	**4**	**4**	**4**	**12**
K N-METHYLDITHIOCARBAMATE [MITC]	**4**	**4**	**4**	**12**
CHLORPYRIFOS	**4**	**3**	**4**	**11**
MOLINATE	**4**	**3**	**4**	**11**
PROPARGITE	**4**	**3**	**4**	**11**
SODIUM TETRATHIOCARBONATE [CS_2]	**3**	**4**	**4**	**11**
SULFURYL FLUORIDE	4	4	3	11
2,4-D, DIMETHYLAMINE SALT	3	3	4	10
ACROLEIN	**2**	**4**	**4**	**10**
CHLOROTHALONIL	3	3	4	10
DIAZINON	**3**	**3**	**4**	**10**
DIURON	**4**	**3**	**3**	**10**
MALATHION	**3**	**3**	**4**	**10**
MANEB	4	2	4	10
PARAQUAT DICHLORIDE	4	2	4	10
PROPANIL	**4**	**2**	**4**	**10**
TRIFLURALIN	**4**	**3**	**3**	**10**
ACEPHATE	2	3	4	9
ALDICARB	2	3	4	9
CAPTAN	3	2	4	9
CARBARYL	2	3	4	9
DIMETHOATE	**2**	**3**	**4**	**9**
IPRODIONE	**2**	**3**	**4**	**9**
MANCOZEB	3	2	4	9
MCPA, DIMETHYLAMINE SALT	3	3	3	9
NALED	**2**	**3**	**4**	**9**
OXYFLUORFEN	**3**	**3**	**3**	**9**
PERMETHRIN	**3**	**3**	**3**	**9**
PHOSMET	**3**	**3**	**3**	**9**
S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE	**2**	**3**	**4**	**9**
SIMAZINE	**3**	**3**	**3**	**9**
ZIRAM	3	2	4	9
AZINPHOS METHYL	**1**	**3**	**4**	**8**
BENSULIDE	2	3	3	8
CHLORINE	3	4	1	8
CHLORTHAL-DIMETHYL	2	3	3	8
CYPERMETHRIN	**2**	**3**	**3**	**8**
DICOFOL	**1**	**3**	**4**	**8**
ENDOSULFAN	**1**	**3**	**4**	**8**
ETHEPHON	3	3	2	8
GLYPHOSATE, ISOPROPYLAMINE SALT	4	2	2	8
IMIDACLOPRID	2	3	3	8
METHOMYL	2	3	3	8
NITROGEN, LIQUIFIED	3	4	1	8
PENDIMETHALIN	3	3	2	8
PETROLEUM HYDROCARBONS	3	4	1	8
SODIUM HYPOCHLORITE	3	4	1	8
THIOBENCARB	**3**	**3**	**2**	**8**

Table 7. Top 25 pesticides used within five miles of Parlier during 2003. Pesticides in blue/bold are included in the monitoring. All pesticides listed here would have a Parlier use rating of 4. Pesticides in **italics* would have a higher total rating based on their Parlier use instead of statewide use. The highest rated pesticides not included in the monitoring (based on Parlier use) are chloropicrin (total rating 12), ziram (10), paraquat (10), and captan (10).

Parlier Use Rank	Pesticide	Statewide (Parlier) Use Rating	Volatility Rating	Risk Assess Rating	Total Statewide (Parlier) Rating
1	**SULFUR**	**4**	**2**	**1**	**7**
2	PETROLEUM OIL, UNCLASSIFIED	4	2	1	7
3	MINERAL OIL	4	2	1	7
4	**1,3-DICHLOROPROPENE**	**4**	**4**	**4**	**12**
5	CRYOLITE	4	2	1	7
6	**COPPER HYDROXIDE**	**4**	**2**	**1**	**7**
7	**METHYL BROMIDE**	**4**	**4**	**4**	**12**
8	GLYPHOSATE, ISOPROPYLAMINE	4	2	2	8
9	****PHOSMET****	***3 (4)***	***3***	***3***	***9 (10)***
10	**ZIRAM**	*3 (4)*	*2*	*4*	*9 (10)*
11	**CHLORPYRIFOS**	**4**	**3**	**4**	**11**
12	****COPPER OXIDE (OUS)****	***2 (4)***	***2***	***1***	***5 (7)***
13	**METAM-SODIUM**	**4**	**4**	**4**	**12**
14	**SIMAZINE**	**4**	**2**	**1**	**7**
15	**PROPARGITE**	**4**	**2**	**4**	**10**
16	PARAQUAT DICHLORIDE	4	2	4	10
17	CHLOROPICRIN	4	4	4	12
18	PETROLEUM DISTILLATES	4	2	1	7
19	****IPRODIONE****	***2 (4)***	***3***	***4***	***9 (11)***
20	**PETROLEUM DISTILLATES, REFINED**	*2 (4)*	*4*	*1*	*7 (9)*
21	CALCIUM HYDROXIDE	4	2	1	7
22	**FORMETANATE HYDROCHLORIDE**	*0 (4)*	*1*	*2*	*3*
23	****OXYFLUORFEN****	***3 (4)***	***3***	***3***	***9 (10)***
24	****COPPER****	***1(4)***	***2***	***1***	***4 (7)***
25	*CAPTAN*	*3 (4)*	*2*	*4*	*9 (10)*

Table 8. Use for 2003 within five miles of Parlier for pesticides included in the monitoring. WILL UPDATE TO INCLUDE NUMBER OF ACRES

Type of Pesticide	Pesticide	2003 Use (lbs)	# of Applications
Fumigant	1,3-Dichloropropene	248,547	97
	Metam-sodium	15,468	12
	Methyl bromide	36,742	20
Fumigant Total		300,756	122
Organophosphate	Azinphos-methyl	504	32
	Chlorpyrifos	25,132	1,266
	Diazinon	2,334	162
	Dimethoate	208	15
	Malathion	621	12
	Naled	0	0
	Phosmet	32,118	1,376
	SSS-Tributylphosphorotrithioate	0	0
Organophosphate Total		62,092	2,927
Carbamates	EPTC	0	0
	Molinate	0	0
	Thiobencarb	0	0
Carbamate Total		0	0
Other	(S)-Metolachlor		
	Carbaryl	1,217	54
	Cypermethrin	1	1
	Dicofol	713	105
	Diuron	2,477	140
	Endosulfan	0	0
	Iprodione	5,372	824
	Oxyfluorfen	3,973	1,576
	Permethrin	10	5
	Propanil	0	0
	Propargite	9,212	397
	Simazine	12,026	1,249
	Sodium Tetrathiocarbonate (CS2)	0	0
	Trifluralin	174	7
Other Total			
Sulfur-Copper	Copper	97,917	1,850
	Sulfur	849,451	4,952
Sulfur-Copper Total		947,368	6,802

Table 9. Use for 2003 within five miles of Parlier for pesticides included in the monitoring, by crop/site. WILL UPDATE TO INCLUDE NUMBER OF ACRES

Crop/Site	**2003 Use (lbs)**	**# of Applications**
ALFALFA	43	3
ALMOND	88,189	62
APPLE	362	26
APRICOT	1,449	65
CHERRY	9,019	71
CHRISTMAS TREE	14	2
CITRUS	1,554	25
CORN (FORAGE - FODDER)	60	1
EGGPLANT	7,540	5
GRAPE	783,466	4,688
GRAPE, WINE	70,465	535
GRAPEFRUIT	28	3
KIWI	19	3
NECTARINE	139,983	3,809
N-OUTDR PLANTS IN CONTAINERS	53	2
ONION, DRY	151	7
ORANGE	2,139	50
PEACH	149,782	3,301
PEAR	1,546	54
PEPPER, FRUITING	2	1
PERSIMMON	5	11
PISTACHIO	2,626	8
PLUM	37,195	1,277
POMEGRANATE	>1	1
PRUNE	652	3
RESEARCH COMMODITY	5	4
SOIL FUMIGATION/PREPLANT	114,983	20
SQUASH	>1	2
SQUASH, SUMMER	5864	4
STRAWBERRY	201	1
TANGERINE	579	160
TOMATO	>1	2
TURF/SOD	23	1
UNCULTIVATED AG	759	1
WALNUT	3,570	49
WATER AREA	<1	1
WATERMELON	3,182	2

Table 10. Locations, frequency of monitoring, and number of samples collected in Parlier. Once monitoring is initiated, samples will be collected for 52 weeks (one year), except as noted. Figure 7 shows a map of the monitoring locations.

Chemicals Monitored	Benavidez Elementary School (or Parlier Jr High)	Chavez Elementary School	Martinez Elementary School	SJVAPCD – Kearney Agricultural Center
DPR – Multiple Pesticides Total of 468 samples	3 days/wk 156 samples	3 days/wk 156 samples	3 days/wk 156 samples	---
DPR – MITC Total of 468 samples	3 days/wk 156 samples	3 days/wk 156 samples	3 days/wk 156 samples	---
ARB – VOC Total of 52 samples	1 day/wk 52 samples	---	---	---
ARB – Metals/Elements Total of 52 samples	1 day/wk 52 samples	---	---	---
SJVAPCD – Hydrocarbons Total of 120 samples	---	---	---	4 every 3 days* 120 samples
SJVAPCD – Aldehydes Total of 120 samples	---	---	---	4 every 3 days* 120 samples
ARB – Criteria Pollutants Particulate matter-2.5 microns	Continuous	---	---	---
SJVAPCD–Criteria Pollutants Carbon monoxide Nitrogen dioxide Ozone	 --- --- ---	 --- --- ---	 --- --- ---	 Continuous Continuous Continuous

* Four 3-hour samples collected on one day of every three days between July and September.

Table 11. Township, range and sections used to define the agricultural boundary for the Parlier air monitoring study. Figure 4 shows a map with the boundaries.

Meridian	Township	Range	Section	Township	Range	Section	Township	Range	Section
M	14S	23E	33	15S	22E	30	16S	21E	11
	14S	23E	34	15S	22E	31	16S	21E	12
	14S	23E	35	15S	22E	32	16S	21E	13
	15S	21E	1	15S	22E	33	16S	22E	1
	15S	21E	11	15S	22E	34	16S	22E	2
	15S	21E	12	15S	22E	35	16S	22E	3
	15S	21E	13	15S	22E	36	16S	22E	4
	15S	21E	14	15S	23E	2	16S	22E	5
	15S	21E	23	15S	23E	3	16S	22E	6
	15S	21E	24	15S	23E	4	16S	22E	7
	15S	21E	25	15S	23E	5	16S	22E	8
	15S	21E	26	15S	23E	6	16S	22E	9
	15S	21E	27	15S	23E	7	16S	22E	10
	15S	21E	34	15S	23E	8	16S	22E	11
	15S	21E	35	15S	23E	9	16S	22E	12
	15S	21E	36	15S	23E	10	16S	22E	13
	15S	22E	1	15S	23E	11	16S	22E	14
	15S	22E	2	15S	23E	12	16S	22E	15
	15S	22E	3	15S	23E	13	16S	22E	16
	15S	22E	4	15S	23E	14	16S	22E	17
	15S	22E	5	15S	23E	15	16S	22E	18
	15S	22E	6	15S	23E	16	16S	22E	19
	15S	22E	7	15S	23E	17	16S	22E	20
	15S	22E	8	15S	23E	18	16S	22E	21
	15S	22E	9	15S	23E	19	16S	22E	22
	15S	22E	10	15S	23E	20	16S	22E	23
	15S	22E	11	15S	23E	21	16S	22E	24
	15S	22E	12	15S	23E	22	16S	23E	2
	15S	22E	13	15S	23E	23	16S	23E	3
	15S	22E	14	15S	23E	24	16S	23E	4
	15S	22E	15	15S	23E	25	16S	23E	5
	15S	22E	16	15S	23E	26	16S	23E	6
	15S	22E	17	15S	23E	27	16S	23E	7
	15S	22E	18	15S	23E	28	16S	23E	8
	15S	22E	19	15S	23E	29	16S	23E	9
	15S	22E	20	15S	23E	30	16S	23E	10
	15S	22E	21	15S	23E	31	16S	23E	11
	15S	22E	22	15S	23E	32	16S	23E	15
	15S	22E	23	15S	23E	33	16S	23E	16
	15S	22E	24	15S	23E	34	16S	23E	17
	15S	22E	25	15S	23E	35	16S	23E	18
	15S	22E	26	15S	23E	36	16S	23E	19
	15S	22E	27	16S	21E	1	16S	23E	20
	15S	22E	28	16S	21E	2	16S	23E	21

Table 12. Detection limits and quantitation limits for the monitored pesticides. Detection and quantitation limits are approximate and will vary with the amount of air sampled and interferences present. THESE ARE PRELIMINARY AND SUBJECT TO CHANGE.

Pesticide	**Method Detection Limit (ng/m^3)**	**Quantitation Limit (ng/m^3)**
Acrolein		
Arsenic		
Azinphos-methyl	7.4	46.3
Carbon disulfide		
Chlorpyrifos	2.9	11.6
Chlorpyrifos oxygen analog	2.9	11.6
Copper		
Cypermethrin	19.5	46.3
DDVP	1.7	11.6
Diazinon	1.2	11.6
Diazinon oxygen analog	3.8	11.6
1,3-dichloropropene		
Dicofol	7.2	23.1
Dimethoate	2.6	11.6
Dimethoate oxygen analog	1.9	11.6
Diuron	6.0	11.6
Endosulfan	8.3	23.1
Endosulfan sulfate	10.8	23.1
EPTC	1.7	11.6
Formaldehyde		
Iprodione		
Malathion	3.1	11.6
Malathion oxygen analog	1.3	11.6
Metam-sodium (MITC)		
Methyl bromide		
Metolachlor	2.7	11.6
Molinate	2.0	11.6
Oryzalin	1.8	11.6
Oxyfluorfen	24.7	46.3
Norflurazon	4.9	11.6
Permethrin	14.3	46.3
Phosmet		
Propanil	2.9	11.6
Propargite	16.5	23.1
SSS-tributyltriphosphorotrithioate (DEF)	1.8	11.6
Simazine	1.3	11.6
Sulfur		
Thiobencarb	7.4	23.1
Trifluralin	10.5	46.3
Xylene		

Table 13. Health screening levels for pesticides included in the monitoring. THESE ARE THE SCREENING LEVELS FOR PESTICIDES IN THE LOMPOC STUDY. DPR WILL REVIEW AND UPDATE THESE VALUES FOR THE PARLIER PROJECT.

Pesticide (Active Ingredient)	Acute Screening Level (ng/m^3)	Seasonal Screening Level (ng/m^3)	Chronic Screening Level (ng/m^3)
Acrolein			
Arsenic			
Azinphos-methyl			
Carbon disulfide			
Chlorpyrifos	1,200	850	510
Copper			
Cypermethrin			
Diazinon	83	83	83
1,3-dichloropropene			
Dicofol	68,000	4,930	2,040
Dimethoate	34,000	17,000	850
Diuron			
Endosulfan			
EPTC	230,000	240,000	8,500
Formaldehyde			
Iprodione	340,000	102,000	102,000
Malathion	40,000	29,000	29,000
Metam-sodium (MITC)	820,000	3,000	300
Methyl bromide	66,000		
Metolachlor	312,000	170,000	170,000
Molinate			
Naled	900	648	648
Oryzalin			
Oxyfluorfen			
Norflurazon			
Permethrin	64,000	20,230	20,230
Phosmet			
Propanil			
Propargite			
SSS-tributyltriphosphorotrithioate (DEF)			
Simazine	85,000		
Sulfur			
Thiobencarb			
Trifluralin	1,700,000	40,800	40,800
Xylene			

FIGURES

Figure 1. Map showing Parlier approximately 20 miles southeast of Fresno.

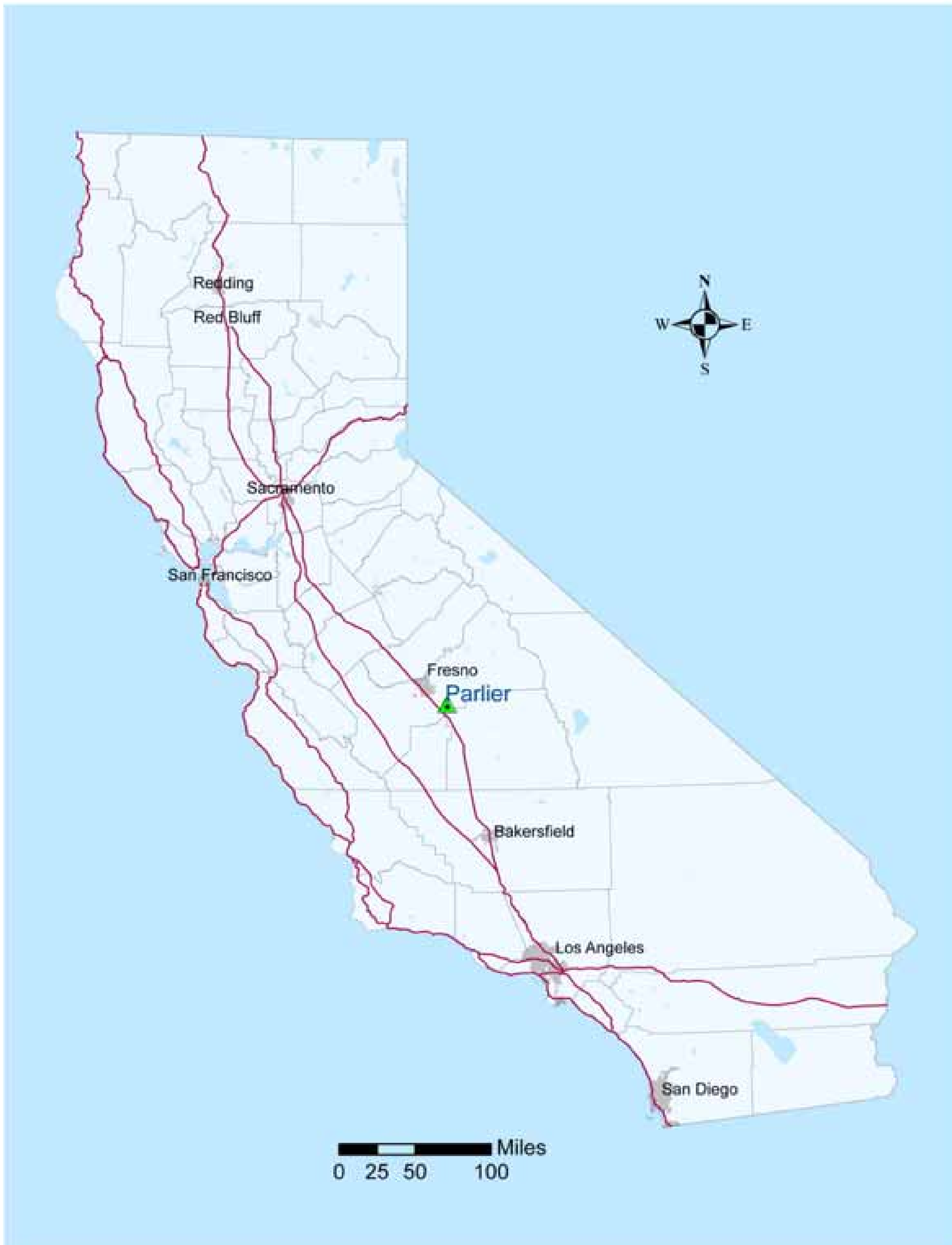

Figure 2. Summary of wind direction and wind speed during 2004 at the SJVAPCD monitoring station, approximately 0.5 miles southeast of Parlier. The direction of the spokes indicates the direction the wind is coming from. The length of the spokes indicates the percentage of time in that direction. The width and color of the spokes indicates the wind speed.

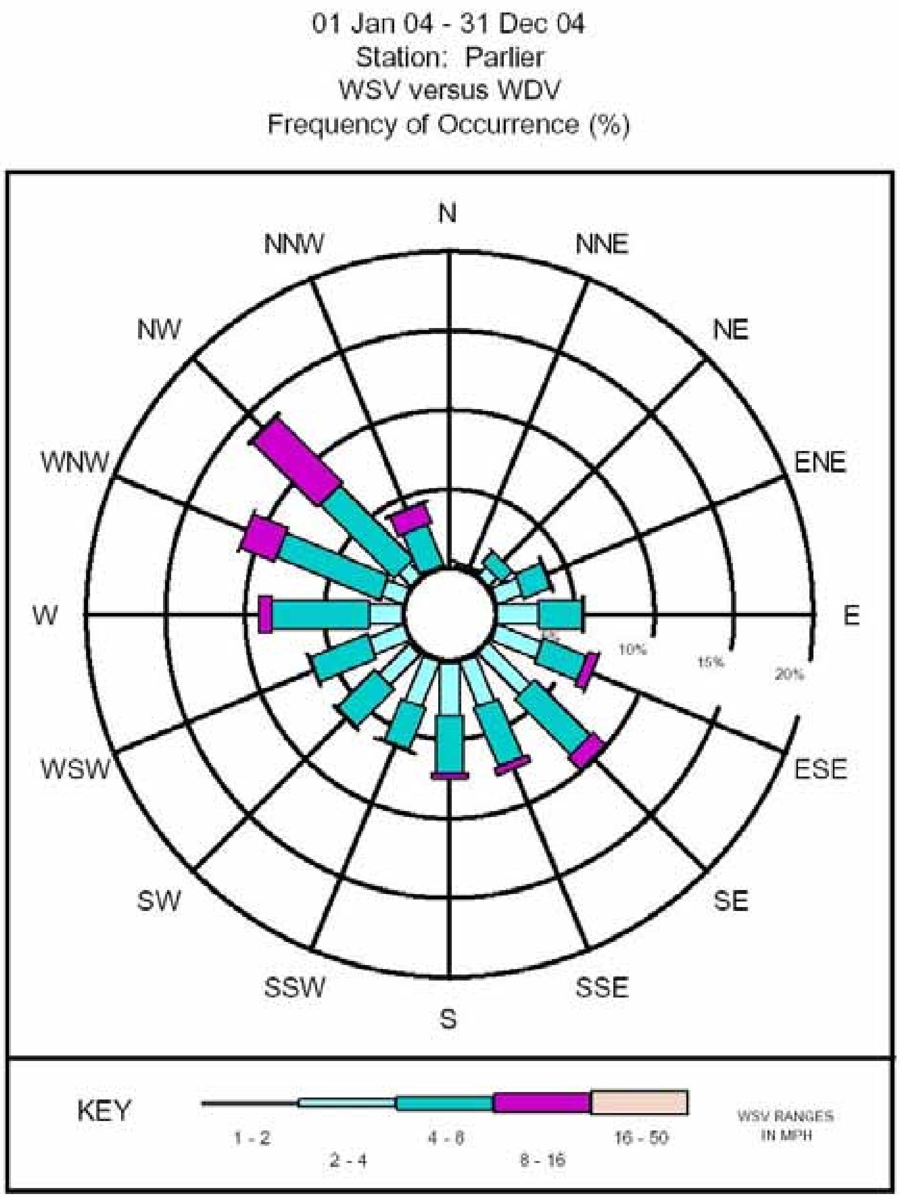

Figure 3. Amounts and locations of fumigant applications (chloropicrin, 1,3-dichloropropene, metam-sodium, and methyl bromide) within five miles of Parlier during 2002. REPLACE WITH 2003

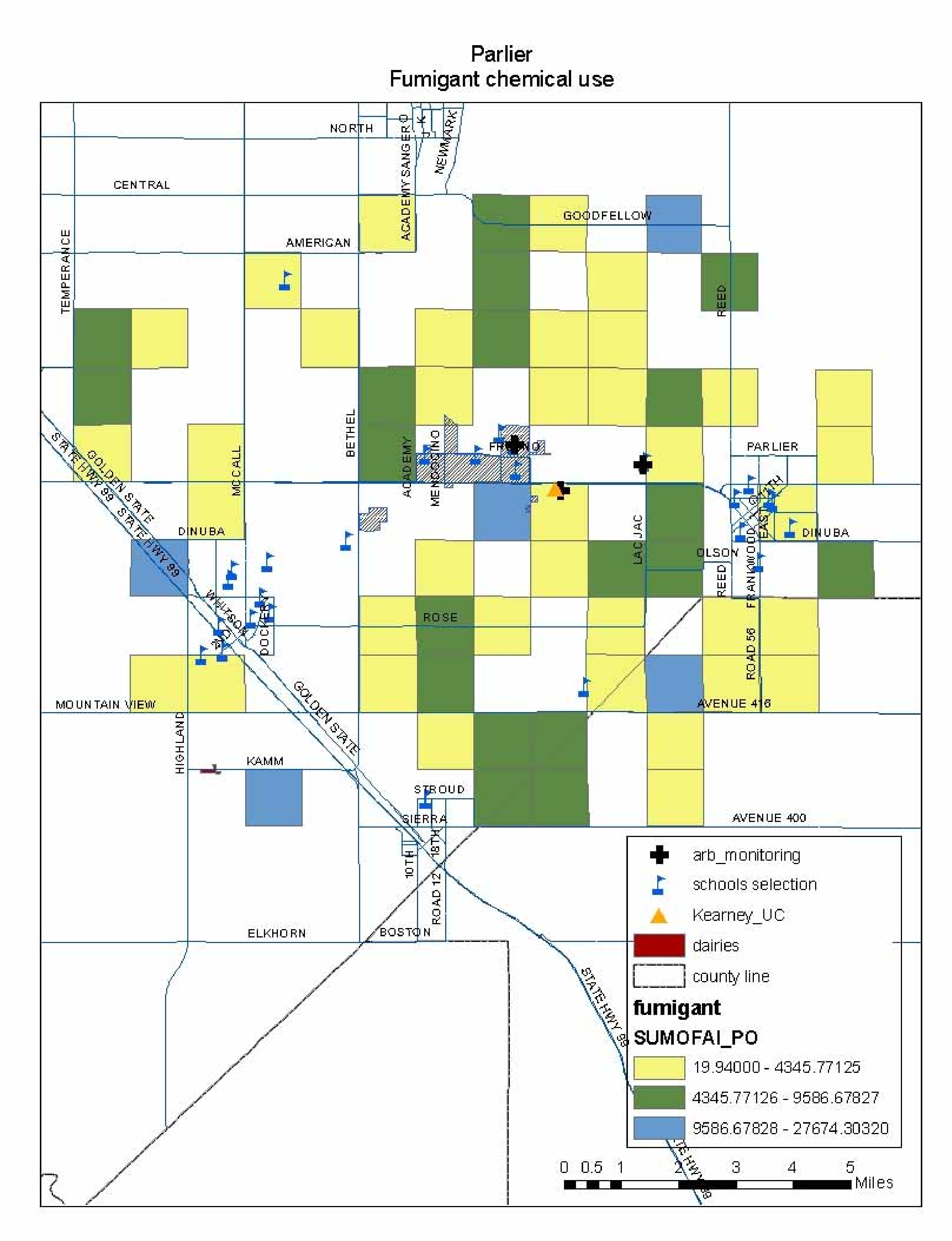

Figure 4. Amounts and locations of organophosphate applications within five miles of Parlier during 2002. REPLACE WITH 2003

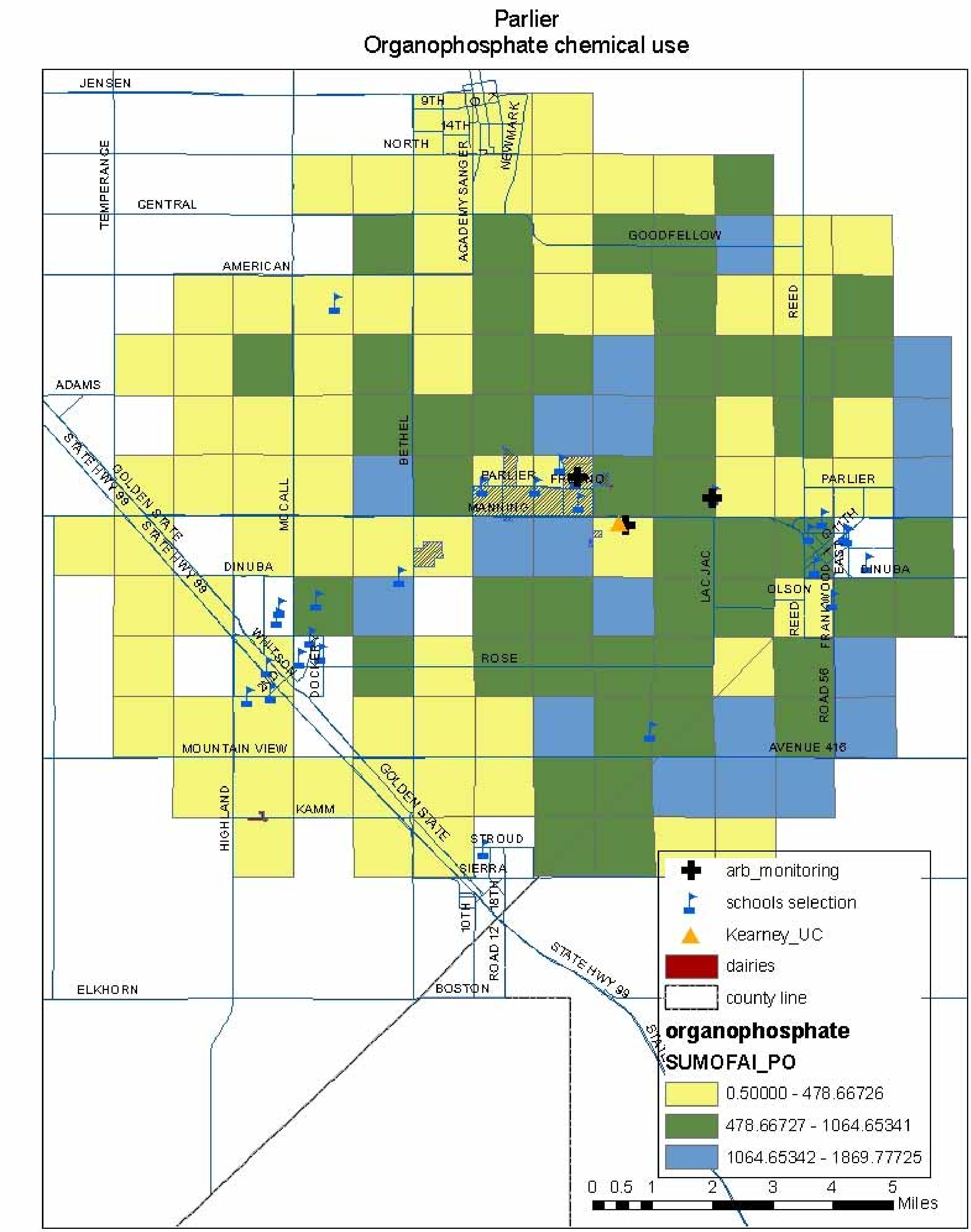

Figure 5. Amounts and locations of copper and sulfur applications within five miles of Parlier during 2002. REPLACE WITH 2003

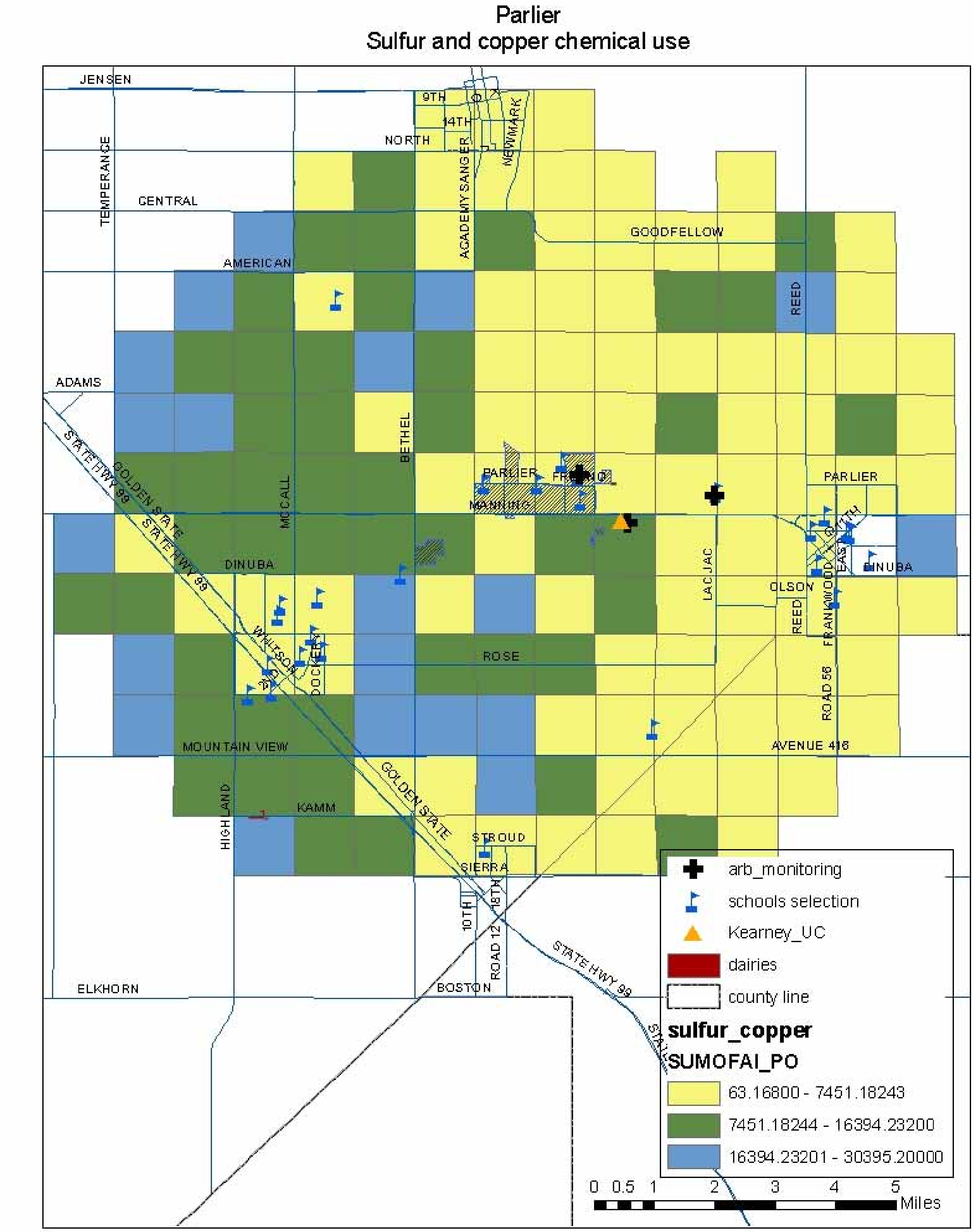

Figure 6. Amounts and locations of other pesticide applications within five miles of Parlier during 2002. REPLACE WITH 2003

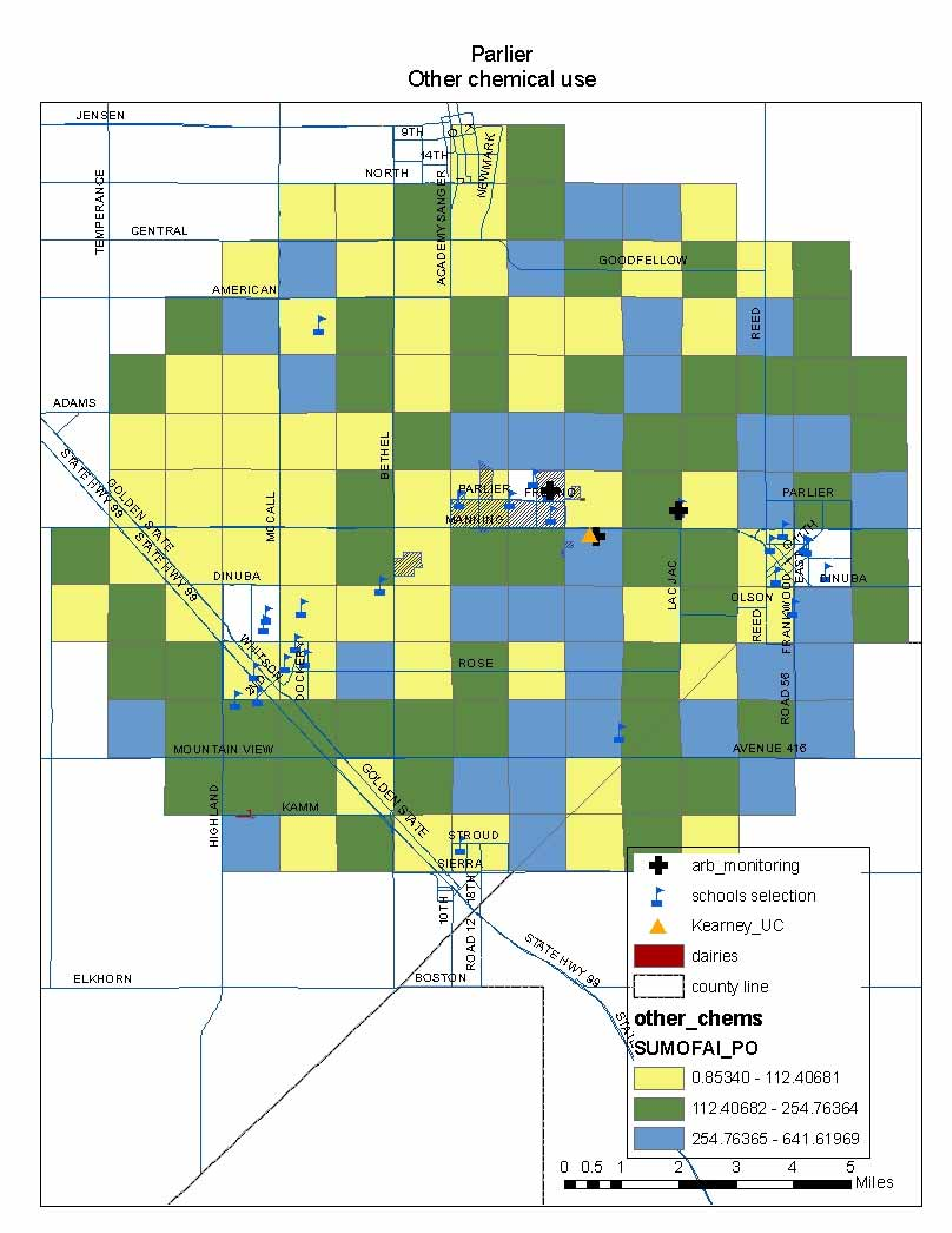

Figure 7. Locations of monitoring stations and population density in Parlier.

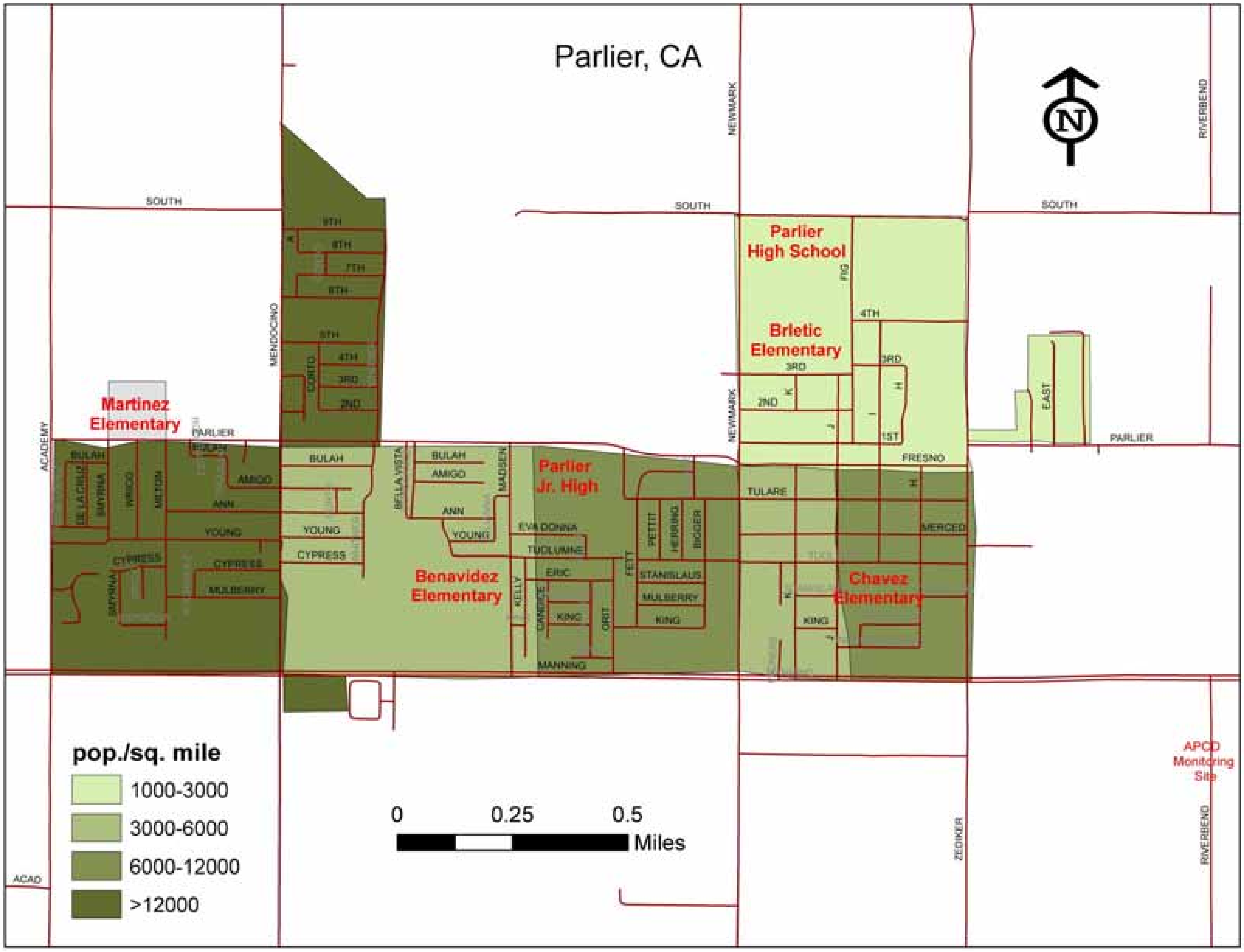

Figure 8. Township, range and sections used to define the agricultural boundary for the Parlier air monitoring study.

ATTACHMENT I – HISTORICAL MONITORING FOR THE TOXIC AIR CONTAMINANT PROGRAM

HISTORICAL MONITORING FOR THE TOXIC AIR CONTAMINANT PROGRAM

The Air Resources Board, in consultation with DPR, conducts ambient monitoring for a variety of pesticides in accordance with the Toxics Air Contaminant (TAC) monitoring program. Monitoring for pesticides is conducted in counties with the highest use for a particular pesticide to be monitored and during the season of highest use. Information is available from ambient air sampling conducted under the TAC program for 12 of the pesticides included in the monitoring study in Parlier: 1,3-dichloropropene, chlorpyrifos, diazinon, endosulfan, EPTC, malathion, MITC, methyl bromide, molinate, permethrin, propargite, simazine, and S,S,S-tributyl phosphorotrithioate. Summaries of the TAC monitoring are given in Attachment I.

The fumigants, 1,3-dichloropropene (1,3-D) and methyl bromide have been monitored over several studies. 1,3-D was measured over the course of eight days in Merced County in April 1990 (California Air Resources Board, 1991). The maximum concentration was 160 micrograms per cubic meter (µg/m^3) and the average was 24 µg/m^3. Following suspension of 1,3-D use in California, ARB monitored ambient air concentrations in Merced County in March through April 1995 during reintroduction of use of 1,3-D with mitigation measures m^3 (California Air Resources Board, 1995). The 24-hour concentrations ranged from no detectable amount (ND) to 7.4 µg/m^3. Similar monitoring conducted in Kern County during May to December, 1995 measured concentrations up to 27.0 µg/m^3 (California Air Resources Board, 1996). In July 1996, following permit condition revisions, 24-hour 1,3-D concentrations measured in Kern County ranged from 0.10 µg/m^3 to 13 µg/m^3 (California Air Resources Board, 1997). The highest 24-hour ambient air concentrations measured in Kern in 2000 and 2001 were 135 µg/m^3 and 96 µg/m^3, respectively (California Air Resources Board, 2000 and 2002b). In Monterey and Santa Cruz Counties the highest 24-hour concentrations measured were 4.34 µg/m^3 and 18.9 µg/m^3 in 2000 and 2001, respectively (California Air Resources Board, 2001a and 2002a).

Ambient air concentration of methyl bromide was also monitored in Kern, Monterey and Santa Cruz Counties in 2000 and 2001(California Air Resources Board, 2000, 2001a, 2002a and 2002b). The highest 24-hour concentrations measured in Kern in 2000 and 2001 were 55 µg/m^3 and 98.3 µg/m^3, respectively. In Monterey and Santa Cruz Counties the highest 24-hour concentrations measured were 119 µg/m^3 and 142 µg/m^3 in 2000 and 2001, respectively.

MITC was measured in Kern County in July 1993 using sorbent tubes (Baker et al., 1996). at four sites over the course of eight days. Four sites were measured over the course of eight days with 83 percent of the samples above the minimum quantitation level of 0.01 µg/m^3. The maximum 24-hour concentration was 18 µg/m^3, the average was 5.8 µg/m^3, and the mean urban background concentration was 2.1 µg/m^3. In June 2000, ARB monitored for MITC and MIC (another breakdown product of metam-sodium) in Kern County using sorbent tubes (ARB, 2003a) at five sites over the course of eight weeks. The 8-week average concentrations for MITC ranged from 0.12 µg/m^3 to 2.5 µg/m^3 at the five sites with 44 percent of the samples containing concentrations of MITC above the EQL of 0.42 µg/m^3. Of the 396 ambient air samples, none contained MIC concentrations above the EQL of 0.42 µg/m^3. The urban background site had a maximum 24-hour concentration of 1.7 µg/m^3 and 42 percent of the samples contained a concentration above the EQL of 0.42 μg/m^3. In the fall of 2000, ARB monitored ambient air concentrations of MITC and MIC in Monterey and Santa Cruz Counties at five sites for eight weeks, four 24-hour samples per week. Of the 192 samples, only one sample (0.43 μg/m^3) had a concentration of MITC above the EQL of 0.42 μg/m^3, and two samples were below the EQL but above the MDL. None of the samples contained any detectable concentration of MIC. There were no measurable concentrations of MITC or MIC at the urban background sampling location.

Chlorpyrifos and its oxygen analog were measured in Tulare County during May and June 1996 (California Air Resources Board, 1998b). The maximum concentration was 0.815 μg/m^3 or 815 nanogram per cubic meter (ng/m^3), and the mean urban background concentration was 27 ng/m^3.

Diazinon was measured in Fresno County during January and February 1997 at four sites over a six-week period (California Air Resources Board, 1998a). The maximum concentration was 290 ng/m^3, and all urban background sample concentrations were below the level of quantitation.

Ambient air monitoring of endosulfan was conducted in Fresno County from July through August, 1996 (California Air Resources Board, 1998c). Chemical analysis was performed for two isomers of endosulfan (endosulfan I and endosulfan II) as well as endosulfan sulfate. The highest 24-hour values observed for the study were 140 ng/m^3 and 26 ng/m^3 for endosulfan I and II, respectively. Endosulfan sulfate was not found above the quantification limit of 6.6 ng/m^3.

EPTC was measured in Imperial County during October and November 1996 at four sites over the course of 24 days (California Air Resources Board, 1998d). The maximum EPTC concentration was 240 ng/m^3, and all of the urban background samples had concentrations below the limit of quantitation.

Malathion and its breakdown product malaoxon were measured in Imperial County during February and March 1998 (California Air Resources Board, 1999a). Four sites were measured over the course of 12 days. The maximum malathion concentration was 90 ng/m^3, and the mean urban background concentration was 5.7 ng/m^3.

Molinate was measured in Colusa County during peak use period in May, 1992 (Kollman, 1995). Ambient 24-hour concentrations ranged from 160 to 1170 ng/m^3.

Naled/dichlorvos (DDVP) were measured in Tulare County during May and June 1991 using XAD-2, and analyzed by gas chromatography (California Air Resources Board, 1993). Four sites were measured over the course of 16 days and 14 percent of the sample concentrations were above the minimum quantitation level of 40 ng/m^3. The maximum concentration was 65 ng/m^3, and the mean urban background concentration was 68 ng/m^3.

Permethrin was measured in Monterey County during August and September 1997 at four sites over the course of 24 days. (California Air Resources Board, 1998e). Five percent of the sample concentrations were above the limit of detection, but were below the limit of quantitation (15 ng/m^3 for a 24-hour sampling period).

Propargite was measured in Fresno and Kings Counties from June 24 to August 4, 1999 (California Air Resources Board, 2001b). The highest 24-hour propargite concentration was 1300 ng/m^3. Fourty percent of the samples were above the quantitation limit of 23 ng/m^3.

Simazine was measured in Fresno County during February through April 1998 at four sites over the course of 24 days (California Air Resources Board, 1999b). The maximum concentration was 18 ng/m^3; all background sample concentrations were below the estimated quantitation limit.

The cotton defoliant S,S,S-tributyl phosphorotrithioate (DEF) was monitored four days a week at four sites in Fresno County during September through early November in 1987 (ARB, 1988). Maximum detection was 330 ng/m^3, and 17 percent of the urban background samples contained concentrations above the MDL of 1.1 ng/m^3.

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California Air Resources Board. 1996. Ambient Air Monitoring in Kern County for Telone (1,3-dichloropropene) During DowElanco's Commercial Reintroduction, May-December, 1995. Project No. C94-071-K. November 8, 1996. Sacramento, CA.

California Air Resources Board. 1997. Report for 1996 Ambient Monitoring of Telone in Kern County. Project No. C96-045. October 14, 1997. Sacramento, CA.

California Air Resources Board. 1998a. Ambient Air Monitoring of Diazinon in Fresno County

During Winter, 1997. Project No. C96-036. April 6, 1998. Sacramento, CA.

California Air Resources Board. 1998b. Application and Ambient Air Monitoring of Chlorpyrifos (and the oxon analogue) in Tulare County During Spring/Summer, 1996. Project No. C96-041. April 7, 1998. Sacramento, CA.

California Air Resources Board. 1998c. Air Monitoring of Endosulfan in Fresno County (Ambient) and in San Joaquin County (Application). Project No. C96-034. April 17, 1998. Sacramento, CA.

California Air Resources Board. 1998d. Air Monitoring of EPTC in Merced County (Application) and in Imperial County (Ambient). Project No. C96-035. June 10, 1998. Sacramento, CA.

California Air Resources Board. 1998e. Application (Butte County) and Ambient (Monterey County) Air Monitoring of Permethrin. Project No. 97-041. November 17, 1998. Sacramento, CA.

California Air Resources Board. 1999a. Application and ambient air monitoring of Malathion in Imperial County. Project No. C98-002. January 28, 1999. Sacramento, CA.

California Air Resources Board. 1999b. Application (Tulare County) and Ambient (Fresno County) Air Monitoring of Simazine. Project No. C97-071. November 22, 1999. Sacramento, CA.

California Air Resources Board. 2000. Ambient Air Monitoring for Methyl Bromide and 1,3-dichloropropene in Kern County – Summer 2000. Project No. C00-028. December 27, 2000. Sacramento, CA.

California Air Resources Board. 2001a. Ambient Air Monitoring for Methyl Bromide and 1,3-dichloropropene in Monterey/Santa Cruz Counties – Fall 2000. Project No. C00-028. January 31, 2001. Sacramento, CA.

California Air Resources Board. 2001b. Report for the Application and Ambient Air Monitoring for Propargite and Bifenthrin in Fresno and Kings Counties. Project Nos. C99-032, C99-032a, C99-033, and C99-033a. August 8, 2001. Sacramento, CA

California Air Resources Board. 2002a. Ambient Air Monitoring for Methyl Bromide and 1,3-dichloropropene in Monterey and Santa Cruz Counties – Fall 2001. Project No. P-01-004. March 29, 2002. Sacramento, CA.

California Air Resources Board. 2002b. Ambient Air Monitoring for Methyl Bromide and 1,3-dichloropropene in Kern County – Summer 2001. Project No. P01-004. June 20, 2002. Sacramento, CA.

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California Air Resources Board. 2003b. Ambient Air Monitoring for Chloropicrin and Breakdown Products of Metam Sodium in Monterey and Santa Cruz Counties – Fall 2001. Project No. P01-004. December 23, 2003. Sacramento, CA.

ATTACHMENT II – STANDARD OPERATING PROCEDURES

These will be included in the final protocol.

http://www.cdpr.ca.gov/docs/empm/pubs/sops/admn001.htm

http://www.cdpr.ca.gov/docs/empm/pubs/sops/eqai001.pdf

http://www.cdpr.ca.gov/docs/empm/pubs/sops/fsai0101.pdf

http://www.cdpr.ca.gov/docs/empm/pubs/sops/qaqc001.pdf

http://www.cdpr.ca.gov/docs/empm/pubs/sops/qaqc0301.pdf

http://www.cdpr.ca.gov/docs/empm/pubs/sops/qaqc0401.pdf

ATTACHMENT III – PESTICIDE USE PATTERNS

Table 1: Pesticides likely to be monitored under DPR's Environmental Justice Project, Parlier.

<u>Agricultural uses emphasize Parlier area pesticide use patterns. Nonagricultural uses listed are those allowed by California product labels</u>. [Also please see the notes which follow these tables]

COMMON NAME (COMMERICAL NAMES)	ACTION / TARGET PESTS	AGRICULTURAL USES	LABELED NONAGRICULTURAL USES
azinphos-methyl (Guthion, Gowan Azinphos, Azinphosmethyl-various brands)	<u>Insecticide</u>; organophosphate chemical *(see definition in notes at end of table)* for control of a broad spectrum of insects, mites, and other arthropod pests	Ground or aerial preplant or in-crop application to all nuts, vegetables, and fruits (including raisins), grains, forage/fodder crops, pulses, cotton, ornamentals; used in nurseries; trees/forestry	None
chlorine (several labels)	<u>Antimicrobial</u>; used to kill bacteria, fungi, other animal/plant pathogens, and algae	Preventive or postharvest disinfection of poultry, eggs, fish, meat, dairy, turf, and vegetable and fruit crops, including nectarines, peaches, and plums	Used in commercial, industrial, and residential settings including packing houses, water systems and water treatment, swimming pools, and other aquatic sites
chlorpyrifos (Dursban, Lorsban, Nufos, Lock-On, Chlorpyrifos-various brands)	<u>Insecticide</u>; an organophosphate chemical *(see notes at end)* effective against a broad spectrum of arthropod pests including flies, mosquitoes, cockroaches, ants, wasps, termites, ticks and lice	Many crops including grapes and wine grapes, raisins, nectarines, peaches, plums; all use on post-bloom apples or tomatoes prohibited; used for quarantine treatment, in nurseries and greenhouses, and with turf and ornamentals; animal husbandry premises, livestock and livestock ear tags	**Dursban formerly used widely in homes and gardens; these uses phased out as a result of an agreement between the U.S. EPA and the manufacturer. Some nonagricultural uses of chlorpyrifos by professional pest control operators and vector control districts are still allowed.**
copper hydroxide	<u>Antimicrobial</u>; used to	Ground or aerial applications to a	In wood preservatives, coatings,

COMMON NAME (COMMERICAL NAMES)	ACTION / TARGET PESTS	AGRICULTURAL USES	LABELED NONAGRICULTURAL USES
(Champ, Champion, Kocide, Nu-Cop, etc.)	kill fungi, bacteria, and algae	broad range of crops, such as all fruits (including raisins), nuts, and field crops, vegetables; ornamentals, turf/lawns, mulch; in greenhouses, nurseries, and gardens; trees/forestry/lumber	and marine anti-foulant; applied to fabric surfaces; used in industrial, institutional, and commercial settings for buildings and structures, uncultivated areas (including pavement, rights-of-way), and recreational areas (such as tennis courts, golf courses)
copper oxide (ous) (Nordox, Chem Copp, etc.)	<u>Fungicide</u>; used to control fungi, including crop diseases	Ground or aerial application in a wide range of crops such as nuts, fruits (including grapes and wine grapes, nectarines, peaches, plums), vegetables, pulse, forage, beverage, and field crops; ornamentals, trees	Household use; application to buildings/structures (with arsenic and chromic acid), roofs; antifouling treatment/paint for the wooden parts, bottoms/hulls of boats
copper oxide (ic) (CCA Type-C, Wolman E, Wolmanac)	<u>Fungicide and insecticide</u>, including against termites; combined in some products with arsenic and chromic acid	None	Wood preservative
copper sulfate (basic) (Basicop, Cuprofix Disperss, etc.)	<u>Antimicrobial and disinfectant</u>; used against bacterial and fungus diseases and contamination	Ground or aerial applications in many crops including vegetables, fruits (such as grapes and wine grapes, raisins, nectarines, peaches, plums), all nut crops; trees and ornamentals; used in greenhouses	Food processing/handling facilities, households; septic/sewage systems
copper sulfate (pentahydrate) (Agritec, Bioguard, Roto Rooter Root	<u>Antimicrobial, dessicant, and molluscicide</u>; for controlling fungi,	Ground or aerial application in crops such as rice, all nut crops, fruits (including grapes and wine grapes, nectarines, peaches, plums),	Wood protection treatments; home/garden; used in commercial, industrial, domestic, and natural aquatic settings such as irrigation

COMMON NAME (COMMERICAL NAMES)	ACTION / TARGET PESTS	AGRICULTURAL USES	LABELED NONAGRICULTURAL USES
Killer, etc.)	bacteria, algae, pond weeds, snails, slugs, shrimp; root control in pipes	ornamentals; used in greenhouses, nurseries; animal husbandry premises; can be applied to cattle; trees/lumber	and drainage, drinking water, and septic/sewage systems, swimming pools, coolers/condensers, toilet bowls, ponds, marshes and wetlands
cypermethrin (Ammo, Demon, Cynoff, Raid, Zep, etc.)	<u>Insecticide</u>; pyrethroid chemical *(see definition in notes at end of table)* used against a broad spectrum of insects and other arthropods including crop pests, ants, roaches, fleas, flies, lice, ticks, mosquitoes and termites	Ground or aerial preplant or in-crop applications to field, forage and oil crops, nuts, vegetables, cotton, ornamentals, lawns, greenhouses, beehives; farm/ag structures including animal husbandry premises; topical applications to horses for fly control; trees/forestry/lumber	Wood protection treatment; fencerows, hedgerows; home, garden, and structural pest control, including fogging; sewage/septic systems; commercial, industrial, and institutional facilities for food and nonfood storage, processing/handling, transport (all manner of vehicles), and marketing, such as hospitals, schools, restaurants; uncultivated land including rights-of-way, paved areas, refuse and solid waste sites, recreation areas
diazinon (AG-500, Diazol, Diazinon-various brands)	<u>Insecticide and acaricide</u>; an organophosphate chemical *(see notes at end)* that kills a broad spectrum of insects and other arthropod pests such as spiders, mites, and ticks	Ground or aerial application to a wide range of crops including grapes and wine grapes, raisins, nectarines, peaches, and plums; rangeland, pastures; nurseries, turf and lawns, ornamentals; almond hulls; farm and animal husbandry premises, farm animals (including cattle ear tags), beehives; forests	Products sold in 2004 and earlier were for domestic dwellings and other buildings and structures; refuse and solid waste sites; rights-of-way, recreational and uncultivated land; aquatic settings including irrigation and drainage systems. **Starting in 2005, all residential products are phased out and only products for outdoor agricultural use may be**

COMMON NAME (COMMERICAL NAMES)	ACTION / TARGET PESTS	AGRICULTURAL USES	LABELED NONAGRICULTURAL USES
			sold. Existing stocks labeled for other purposes may be used indefinitely.
1,3-dichloropropene (Inline, Telone, Tri-Cal, Pic-Clor, etc.)	<u>Soil fumigant</u>; combined with chloropicrin in many products; used for nematode, disease, and insect control	Applications to soil before planting of many crops, such as fruits (including grapes and wine grapes, nectarines, peaches, plums), vegetables, nuts, cotton, ornamentals; used in nurseries, pasture; forestry	None
dicofol (Kelthane)	<u>Acaricide</u>; organochlorine chemical *(see definition in notes at end of tables)* used against mites	Ground or aerial application in selected crops such as cotton, vegetables, nuts, and fruits (including grapes, wine grapes), turf/lawns, ornamental trees; used in gardens, nurseries	Buildings and structures
dimethoate (Cygon, De-Fend, Digon, Prozap, Dimethoate-various brands)	<u>Insecticide and acaricide</u>; Organophosphate chemical *(see notes at end)* effective against a broad spectrum of insect and arthropod pests including flies, mosquitoes, cockroaches, ticks, lice	Ground or aerial application to many crops such as cotton, vegetables, fruits (including grapes, wine grapes, and raisins), ornamentals; nurseries, fallow areas, manure; livestock and poultry; farm/agricultural structures including animal husbandry premises; trees/forestry	Used in household, commercial, and institutional settings including storage and transport facilities, food processing/handling; uncultivated land, refuse and solid waste sites, recreational areas
diuron (Direx, Karmex, etc.)	<u>Algaecide and defoliant</u>; substituted urea chemical effective against algae including	Ground or aerial applications preplant or in-crop on forage and field crops, olives, ornamentals, cotton, grains, vegetables, and fruit	Used in commercial, industrial, and institutional settings such as airports and runways, buildings and structures, storage and

COMMON NAME (COMMERICAL NAMES)	ACTION / TARGET PESTS	AGRICULTURAL USES	LABELED NONAGRICULTURAL USES
	pool scum	including grapes, wine grapes, and peaches; applied as a defoliant for cotton, carrots, and onions; used on fallow land, pastures, farm and animal husbandry premises; lumber	processing areas, rights-of-way and other uncultivated land; in aquatic sites such as aquaria, ponds, lakes and reservoirs, drainage and irrigation systems; preservative for adhesives, paint, and coatings
endosulfan (Thiodan, Phaser, Thionex, Endosulfan-various brands)	Insecticide and acaricide; organochlorine chemical *(see notes at end)* used against a wide range of insect and mite pests	Ground or aerial use in many crops such as cotton, nuts, vegetables, forage crops, ornamentals, and fruits including grapes and wine grapes, nectarines, peaches, and plums; greenhouses, nurseries, gardens; trees/forestry	None
EPTC (Eptam, etc.)	Herbicide; for control of grasses and broadleaf weeds	Ground or aerial application in forage and field crops, nut crops, citrus, potatoes, tomatoes, corn; pine trees; no reported use in the Parlier area during the last five years	None
malathion (Malathion-various brands, Fyfanon, Mosquito B Gon, etc.),.	Insecticide and acaricide; organophosphate chemical *(see notes at end)* effective against a broad spectrum of indoor and outdoor pests including ants, fleas, cockroaches, mosquitoes, wasps, lice and ticks	Ground or aerial preplant or in-crop applications to many crops including grapes and wine grapes, raisins, nectarines, peaches, and plums; also seeds, ornamentals, turf and lawns, nonliving plant material; used in quarantine facilities, nurseries, greenhouses, rangeland and pastures, on livestock, poultry, and pets, and in animal husbandry premises; trees and forestry, lumber	Rights-of-way and other uncultivated land; home and garden; structural, institutional, industrial, and commercial use in rural and urban settings, such as food/feed processing/handling, storage, and marketing facilities, restaurants, schools (indoor) and other buildings and structures; applied to refuse and solid waste sites, and to marshland and aquatic sites for mosquito abatement;

COMMON NAME (COMMERICAL NAMES)	ACTION / TARGET PESTS	AGRICULTURAL USES	LABELED NONAGRICULTURAL USES
			added to wood preservatives, coatings, and paint
methyl bromide (Methyl Bromide- various brands, Brom-O-Gas, Terr-O-Gas, Metabrom, MBR, Pic-Brom, Tri-Com, etc.)	Soil, space and commodity fumigant; combined with chloropicrin in many products; for control of diseases, insects and other arthropod pests, nematodes, snails and slugs, rodents and other mammalian pests, broadleaf weeds and grasses	Applications to soil before planting of ornamental and agricultural crops and turf; used in nurseries and greenhouses, with nonliving plant material, for pre-shipment quarantine, and for disinfection of agricultural equipment, animal husbandry premises and beehives; forestry/lumber **Under an international treaty, the Federal government allows only certain "critical uses" for products manufactured or imported starting January 1, 2005.**	Used in recreational (golf courses), commercial, industrial, institutional, structural, and uncultivated settings; fumigation chambers, storage and transport facilities, food and nonfood processing and manufacturing, restaurants, public buildings, domestic dwellings; water disinfection
molinate (Ordram)	Herbicide; for control of watergrass	Ground or aerial application to rice; almost no reported use in the Parlier area	None
naled (Dibrom, Naled-various brands, Fly Killer D, Legion, Trumpet)	Insecticide and acaricide; organophosphate chemical *(see notes at end)* effective against a broad spectrum of arthropod pests including insects and mites	Ground or aerial applications in pastures, rangeland, and many crops including forage, fodder, and pulse crops, rice, cotton, vegetables, fruits, nuts, ornamentals, turf; animal husbandry premises; trees/forests	Used in a wide range of household, commercial, and institutional settings including food processing/handling facilities, restaurants; uncultivated areas such as refuse and solid waste sites, rights-of-way; municipal and other large-area mosquito control
oxyfluorfen (Goal, Galigan, FirePower,	Herbicide; diphenyl ether chemical for	Ground or aerial application in many crops such as cotton, nuts,	Fencerows, hedgerows; also used in household, structural,

COMMON NAME (COMMERICAL NAMES)	ACTION / TARGET PESTS	AGRICULTURAL USES	LABELED NONAGRICULTURAL USES
etc.)	preemergence and/or postemergence control of certain annual broadleaf and grassy weeds	vegetables, fruits (including grapes, wine grapes, raisins, nectarines, peaches, plums); ornamentals, turf/lawns; farm/ag structures; trees/forestry	commercial, institutional, and industrial settings such as storage areas, airports and landing fields, rights-of-way, and other paved or uncultivated land
permethrin (Pounce, Ambush, etc.)	Insecticide; pyrethroid chemical *(see notes at end)* for control of a broad spectrum of insect and arthropod pests including crop pests and ants, cockroaches, mosquitoes, wasps, fleas, ticks, lice, mites, spiders and termites	Ground or aerial preplant or in-crop applications for all fruits and nuts, forage, oil, and field crops, cotton, vegetables, herbs, ornamentals, turf/lawns, greenhouses; also applied to pets, livestock, and animal husbandry premises; trees/forestry	Applied as an insect repellant; also home and garden, structural, area fogging, and aquatic uses
propanil (Duet, Stam, Wham, Super Wham)	Herbicide; anilide chemical for control of aquatic weeds, broadleaf weeds, and grasses	Postemergence ground/aerial applications in rice; no reported use in the Parlier area	None
propargite (Comite, Omite)	Acaricide; sulfite ester chemical used to control mites	Ground or aerial application to a broad range of crops such as cotton, vegetables, nuts, ornamentals, and fruits including nectarines, peaches, plums, grapes and wine grapes, raisins; forest trees; reported use of Comite is negligible in the Parlier area; reported use of Omite has been declining, to about 3,500 ac in 2004	None

COMMON NAME (COMMERICAL NAMES)	ACTION / TARGET PESTS	AGRICULTURAL USES	LABELED NONAGRICULTURAL USES
(S)-metolachlor (Pennant, Bicep, or Dual Magnum; Medal)	Herbicide; chloroacetamide chemical for weed control	Ground or aerial application in selected crops including cotton, field and pulse crops, vegetables, fruits; tree nurseries, turf, ornamentals, landscape plantings; reported use rare in the Parlier area	Rights-of-way, recreational areas, airports and landing fields
S,S,S-tributyl phosphorotrithioate [tribufos] (Def, Folex)	Defoliant; organophosphate chemical *(see notes at end)* used to remove leaves from the crop	Ground or aerial spray application to cotton; no reported use in Parlier	None
simazine (Princep, Sim-Trol, Simazine-various brands, Aquazine, etc.)	Herbicide and algaecide; Triazine chemical for control of most annual grasses and broadleaf weeds	Ground or aerial applications in forage and field crops, olives, carob, nuts, fruit (including grapes and wine grapes, nectarines, peaches, plums), vegetables, ornamentals and nurseries, turf/lawns and sod farm/ag structures and animal husbandry premises; trees/lumber/forestry	Fencerows and shelterbelt plantings; golf courses; uncultivated areas such as rights-of-way; also used in structural, industrial, and aquatic settings
sodium tetrathiocarbonate [CS2] (Enzone, ETK-1101)	Fumigant, or liquid applied to soil; used against fungi, nematodes, and insect pests	Preplant or postharvest use in fruit (including grapes and wine grapes, peaches, plums), nut crops, and roses; often applied through irrigation systems	None
sulfur (Thiosperse, Thiolux, Thioben, Yellow Jacket, Super Six, Kumulus, Microthiol, sulfur dust-various brands, copper-	Acaricide, insecticide, antimicrobial, and soil amendment; used against insect and mite pests, fungal and bacterial plant diseases;	Ground or aerial application on a wide range of crops such as vegetables, fruits (including grapes and wine grapes, raisins, nectarines, peaches, plums), cotton, grains, pulses, forage/fodder crops, all field	Uncultivated land including rights-of-way; recreational areas (such as golf courses); in paint/wood preservatives

COMMON NAME (COMMERICAL NAMES)	ACTION / TARGET PESTS	AGRICULTURAL USES	LABELED NONAGRICULTURAL USES
sulfur dust, etc.)	also in smoke briquets or baits deployed for control of rodents and other mammal pests	and nut crops; ornamentals, turf, trees; used in lawns, gardens, greenhouses, pastures, rangelands; applied to dogs and horses against mange	
thiobencarb (Abolish, Bolero)	Herbicide; for control of aquatic weeds and grasses	Ground or aerial preplant or in-crop application to transplanted and direct-seeded rice fields; no reported use in the Parlier area	None
trifluralin (Treflan, Triap, Trilin, etc.)	Herbicide and growth inhibitor; dinitroaniline chemical for controlling broadleaf and grass weeds	Ground or aerial preplant or in-crop use for many crops such as cotton, nuts, vegetables, and fruits including grapes and wine grapes, raisins, nectarines, peaches, plums; ornamentals, turf/lawns, nursery equipment, greenhouses; trees/forestry/lumber; reportedly applied to about 250-500 ac/yr in the Parlier area	Home and garden; structural, industrial, and uncultivated area applications including pavements, rights-of-way, sewage disposal sites, and recreational areas (golf courses)

Table 2: Additional pesticides that may be included in DPR's Environmental Justice Pilot Project

Agricultural uses emphasize Parlier area pesticide use patterns. Nonagricultural uses listed are those allowed by California product labels. [Also please see the notes which follow these tables]

COMMON NAME (COMMERICAL NAMES)	ACTION / TARGET PESTS	PARLIER AREA AGRICULTURAL USES	LABELED NONAGRICULTURAL USES
chloropicrin (Tri-Clor, Chlor-O-Pic, Metapicrin, Nutrapic)	Fumigant; combined in many products as a warning agent with odorless fumigants methyl bromide and 1,3 dichloropropene; controls bacteria, fungi, arthropods (insects, mites, ticks), nematodes, snails, slugs, and weeds	Preplant application in all agricultural crops, ornamentals, turf; also applied in greenhouses and nurseries, to nonliving plant material, and on uncultivated agricultural land; trees/forestry/lumber	All types of nonagricultural fumigation (buildings and structures, food and nonfood processing/handling, manufacturing, commercial and institutional storage, transport, and water systems)
chlorothalonil (Bravo, Busan, Daconil, Echo, etc.)	Fungicide and antimicrobial; used against fungi, bacteria, algae	Ground or aerial application to fruit (all orchards, grapes and wine grapes), beans and peas, peanuts, herbs, mushrooms, all vegetables and nuts; ornamentals, turf, grass grown for seed; used in greenhouses and nurseries; trees/forestry/lumber	Recreational areas (tennis courts, golf courses); industrial preservative (resin, adhesives, paints and coatings); wood protection treatment, including structures
2,4-D, dimethylamine salt (Banuel, Dri-Clean, Weedar, Weed Master, Weedaxe, Saber, etc.)	Herbicide, growth regulator in citrus; chlorinated phenoxy chemical for the control of broadleaf weeds, including aquatic weeds	Ground or aerial preplant or in-crop applications to fruits (including all orchards, grapes and wine grapes), forage/fodder crops, corn, sugarcane, all nuts and grains, ornamentals, turf/lawns, grasses grown for seed, pastures and	Fencerows, hedgerows, rights-of-way, uncultivated ag and non-ag land, wasteland; natural and artificial aquatic sites, swamps, marshes, irrigation and drainage systems; urban, commercial, institutional, and industrial uses including paved areas

		rangeland, hay silage; landscape maintenance, gardens/mulch; farm/ag structures; trees/forestry/lumber	(airports and landing fields), storage and recreational sites (tennis courts, golf courses); buildings and structures including homes
iprodione (Rovral, Chipco, etc.)	Fungicide; for controlling plant diseases	Ground or aerial applications against many diseases of fruits (including grapes and wine grapes, raisins, nectarines, peaches, plums), nuts, vegetables, cotton, cereals, field crops, oil crops, trees, turf; ornamentals; used in greenhouses and for landscape maintenance	Applied in commercial, institutional, and industrial settings, recreational areas (golf courses)
metam-sodium [MITC] (Metam, Busan, Nemasol, Sectagon 42, Vapam, etc.)	Fumigant; used to kill fungal and bacterial diseases, arthropod pests (insects, mites, shrimp), nematodes, and broadleaf and grassy weeds	Applied to soil before planting; all agricultural crops, ornamentals; forests/lumber	Wood protection treatment; all-purpose fumigant, including for wood structures; water applications such as sewage and waste water systems, aquatic areas
phosmet (Imidan)	Insecticide; organophosphate chemical *(see notes at end)* used against a broad spectrum of crop pests, as well as ticks, lice, and other veterinary pests	Ground or aerial application in fruits (including grapes and wine grapes, nectarines, peaches, plums), nut crops, forage crops, cotton, field crops, ornamentals; parasite control on cattle and pigs; forests	Used in household/domestic settings and for recreational areas, rights-of-way, uncultivated land

Notes

Preplant or in-crop application—At least one product containing that active ingredient is labeled for preplant application, and at least one product is labeled for in-crop application.

Ground or aerial application—At least one product containing that active ingredient is labeled for ground application, and at least one product is labeled for aerial application.

Crops—If at least one product containing that active ingredient is labeled for use on cotton or on Parlier's major crops—grapes, wine grapes, raisins, nectarines, peaches, plums—the table mentions the crop specifically, or by saying "all fruits," or "all orchards." **Crop categories:** If a category such as "field crops" is mentioned, it means that at least one product containing that active ingredient is labeled for use on at least one crop in the category. **Glossary:** "**pulse crops**" include peanuts and various types of peas and beans; "**field crops**" refers to certain crops grown on large areas, such as corn and sugar beets; "**forage/fodder crops**" such as alfalfa and clover are grown for animal food; "**oil crops**" like canola and safflower are grown primarily for extracting oils; "**beverage crops**" includes, for instance, coffee.

Chemicals—Organophosphates are a group of closely related pesticides that affect functioning of the nervous system. They are usually short-lived in the environment, but include some of the most toxic pesticides used in agriculture and can be hazardous to applicators and others who are over-exposed. **Pyrethroids** are a large class of synthetic insecticides produced to duplicate or improve on the natural insecticide produced by chrysanthemum flowers. In California, pyrethroids are often used on fruit and nut trees, field crops, rice, nurseries, and urban landscapes. Surface water runoff and pesticide drift during application can result in contamination and subsequent accumulation in sediment of adjacent waterways. **Organochlorines** (also known as chlorinated hydrocarbons) are a chemically related class of pesticides that contain a high percentage of chlorine. Most organochlorine insecticides were banned or severely restricted because of their carcinogenicity, tendency to persist in the environment and to bioaccumulate (accumulate in the body fat of humans and other animals), and toxicity to wildlife. The best-known organochlorine insecticide was DDT, which was banned more than 30 years ago.

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ATTACHMENT IV – OVERVIEW OF POSSIBLE HEATH EFFECTS FROM PESTICIDES

OVERVIEW OF POSSIBLE HEATH EFFECTS FROM PESTICIDES

This is a description of the major toxic effects that may be associated with overexposure to the pesticides that are likely to be or may be included in the project. Some of these effects were identified in animal studies and some have been identified from human exposure incidents. This is only intended to be a brief overview of each pesticide and is not intended to be a detailed toxicity profile of each pesticide.

Azinphos–methyl, chloropyrifos, diazinon, dimethoate, malathion, naled, phosmet, and S,S,S-tributyl phosphorotrithioate (DEF) all belong to a class of insecticides known as organophosphates (OPs). These insecticides kill insects by direct contact or ingestion by disrupting their normal nervous system functions. They interfere with the acetylcholinesterase enzyme that is necessary for normal nerve transmission. Signs and symptoms associated with OP poisoning in humans include headache, nervousness, blurred vision, weakness, nausea, diarrhea, difficulty breathing, sweating, pin-point pupils, tearing, salivation muscle twitching, muscle weakness, and in severe poisonings convulsions, coma, and death. Severe, acute organophosphate poisoning may rarely be associated with chronic neurological effects. A blood test can document acute OP exposure.

EPTC (eptam), molinate, and thiobencarb are thiocarbamate herbicides. They are similar to the carbamate insecticides, and likewise interfere with the acetylcholinesterase enzyme that is necessary for normal nerve transmission, though somewhat less consistently than the carbamate insecticides. Poisoning can also result in similar signs and symptoms. In addition, exposure of laboratory animals to EPTC has resulted in nerve and heart muscle degeneration. Exposure of laboratory animals to molinate has resulted in decreased fertility, nerve and muscle degeneration, and some indications of carcinogenic effects.

Cypermethrin and permethrin belong to a class of insecticides called pyrethroids. Pyrethroids are synthetic forms of pyrethrins, which is an insecticide derived from an extract of chrysanthemum flowers. Pyrethroids act as contact poisons and affect the nervous system by interfering with the transmission of nerve impulses. Even though they are nerve poisons, they do not inhibit the cholinesterase enzyme, as do the organophosphates and carbamates. A large amount of pyrethroids on the skin can result in feelings of numbness, itching, burning, stinging, tingling, or warmth that could last for a few hours. Large amounts of these chemicals entering the body (through the skin, by inhalation, or orally) could result in dizziness, headache and nausea that might last several hours. Larger amounts could cause muscle twitching, reduced energy, loss of awareness, convulsions, and loss of conspicuousness. Allergic reactions have been seen in some individuals. Animal studies involving lifetime oral exposure to large amounts give some evidence of cancer.

Metam-sodium*, in the presence of water breaks down to* ***MITC*** *(a fumigant) and other compounds. MITC evaporates from the soil (after its application as metam sodium) and thus has the potential to move offsite in the air. MITC is a strong eye, respiratory, and* *skin irritant and can cause damage to these tissues. It can also exacerbate existing respiratory conditions, such as asthma.*

1,3-dichloropropene (1,3-D, Telone) is a fumigant that can readily move from the soil to air and subsequently move offsite in the air. Workers breathing high concentrations of 1,3-D had irritated skin, eyes, nose and throat, coughing, nausea, headache, and fatigue. Short-term exposure of animals has also resulted in weight loss, nasal tissue damage, and death (with a sufficiently high dose). Some long-term studies resulted in carcinogenic effects, and 1,3-D has been classified as a probable human carcinogen.

Methyl bromide is a fumigant that can readily move from the application site to air and subsequently move offsite in the air. Methyl bromide can cause severe irritation to the eyes, skin, and mucus membranes. Neurotoxicity has been observed in humans and laboratory animals after exposure to methyl bromide. In animals, damage has been observed in a variety of tissues, depending on the level and length of exposure. These tissues include nasal tissues, brain, heart, testes, testes, adrenal glands, spleen, and kidney. Methyl bromide caused developmental effects in rats and rabbits. In humans exposed to high concentrations, neurological effects included ataxia, convulsions, and tremors. Sufficiently high exposures can result in death.

Chloropicrin is used both as a fumigant and as a warning agent with other fumigants. It is a liquid at room temperature, but it can readily evaporate and move offsite. It has a strong odor and is a strong eye, respiratory and skin irritant. Exposures to sufficient concentrations in the air can result in tearing, eye irritation, nasal irritation, difficulty breathing, tightness in the chest, and symptoms of respiratory damage. Inhalation exposure to very high concentrations can lead to pulmonary edema, unconsciousness, and death.

Sodium tetrathiocarbonate is applied to the soil, but converts to **carbon disulfide**, sodium hydroxide, hydrogen sulfide, and sulfur in the soil. Hydrogen sulfide and carbon disulfide are released to the air and can move offsite. Carbon disulfide is the pesticidal active ingredient. Hydrogen sulfide has a strong odor and can cause irritation of the eye nose, throat, and exposed body surfaces; nausea; neurological effects; pulmonary edema; and death. A primary toxicological target of carbon disulfide is the nervous system. Toxicity in humans following acute inhalation exposure to very high concentrations of carbon disulfide usually includes symptoms similar to inebriation and a loss of tendon reflexes. Death may occur from respiratory depression. Other symptoms include disorientation, headache, nausea, dizziness, fatigue, heart disturbances, and hallucinations. Longer-term exposures of humans to lower concentrations have resulted in symptoms including polyneuritis, psychoses, gastric disturbances, headaches, impotence, tremors, sleep disturbances, and myopathy. Carbon disulfide also causes reproductive toxicity and has been listed under Proposition 65 as reproductive and developmental toxicant.

Sulfur is found in a variety of fungicides and is also available as a powder. It has a low oral toxicity. However, it can cause skin, eye, and respiratory irritation. Inhalation exposure to large amounts of sulfur dust can cause inflammation of the nasal mucosa, bronchitis, cough, and expectoration.

Propargite is a miticide, is severely irritating to the skin and eyes, and is considered corrosive. These effects have been seen in workers exposed to propargite. Propargite has also been identified as a probable human carcinogen and a developmental toxin based on the results of animal toxicity studies.

Diuron is an herbicide with low toxicity by the oral, dermal, or inhalation routes. It is not a skin or eye irritant. The primary sites of toxicity with repeated oral exposures are blood (hemolytic anemia), urinary bladder, and kidney. Diuron has also demonstrated carcinogenic effects in rats and mice, and has been identified as a likely human carcinogen.

Propanil is an herbicide used primarily on rice. It has a relatively low acute oral or inhalation toxicity, but can cause skin and eye irritation. Longer-term animal studies have indicated toxicity to the blood and blood forming organs, endocrine effects (including testicular toxicity), carcinogenic effects, and possible effects on the immune system.

Trifluralin is an herbicide and has a low acute oral toxicity. It is classified as a dermal sensitizer. Trifluralin has been classified as a possible human carcinogen, based on evidence in male and female rats.

Oxyfluorfen is an herbicide with low acute oral, dermal, and inhalation toxicity. In repeated dose studies in a variety of animals, oxyfluorfen inhibited heme production, resulting in a variety of anemias, and caused mild liver toxicity. Oxyfluorfen also caused liver tumors in mice, resulting in its classification as a possible human carcinogen.

Simazine belongs to a class of herbicides called triazines and has low acute oral, dermal, and inhalation toxicity. Longer-term studies in animals have resulted in effects on a number of blood parameters (e.g., depressed red blood cell count), reduced body weights, and carcinogenic effects. Simazine has been classified as a possible human carcinogen.

Dicofol is an organochlorine insecticide related to DDT, and has moderate acute toxicity. Poisoning can affect the nervous system, liver, and kidneys. Signs associated with acute poisoning in humans include headache, fatigue, nausea, dizziness, weakness, skin irritation, and conjunctivitis, depending on the route of exposure. Very severe poisoning can result in convulsions, coma, or death. Repeated exposure studies in laboratory animals have resulted in toxicity to the nervous system, liver, adrenals, thyroid, and testes. The toxicology data for dicofol is suggestive of endocrine disruption.

Endosulfan is an organochlorine insecticide and is highly acutely toxic by oral and inhalation routes. The primary site of its acute toxicity is the nervous system. Symptoms of acute poisoning include incoordination, imbalance, difficulty breathing, vomiting, diarrhea, convulsions, and loss of consciousness. Repeated dose animal studies have indicated toxicity to the kidney, liver, testes, blood, blood vessels, and immune system. There is also evidence that endosulfan causes endocrine disruption.

Metolachlor is a broad-spectrum herbicide with low acute toxicity. Longer-term studies indicated decreased weight gains and some liver toxicity. There was evidence of liver carcinogenicity in a long-term rat study, but not in a corresponding mouse study.

Copper is ubiquitous in nature and is a necessary nutritional element for animals and plants. Copper compounds are irritating to the gastrointestinal tract. Ingestion of large amounts can lead to a metal taste in the mouth, nausea, vomiting, diarrhea, headache, sweating, and damage to the brain, liver, kidneys, and gastrointestinal tract. Copper compounds can also be corrosive to the skin and eyes. Inhalation can cause irritation of the nose and throat.

Acrolein is a liquid with a pungent odor that readily dissolves in water and evaporates rapidly from water and soil. It is used as an herbicide in aquatic areas and irrigation systems. It is an acute respiratory and eye irritant and sufficiently high exposures can result in death. More prolonged exposures in animal studies have resulted in nasal and respiratory damage.

Chlorthal-dimethyl, also called dacthal or DCPA, is an herbicide with low acute toxicity. Long-term animal studies indicated possible carcinogenic effects in the thyroid and liver. It has been classified as a possible human carcinogen.